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CONTENTS.

Editorial 155
Limiting the Generation of Niagara Power..... 158
The Public Ownership Inquiry Abroad..... 158
Programme for Ohio Electric Light Association..... 158
Annual Convention of the National Electrical Contractors' Association. 159
With the Combined Electrical Engineers in England. By C. T. Wilkinson 162
French Regulation for the Distribution of Electrical Energy..... 163
The Oxidation of Atmospheric Nitrogen in Electric Arcs..... 164
Unification of Central Station Service in St. Louis..... 165
Municipal Plant for Johannesburg, South Africa..... 165
Current News and Notes..... 165
Oil Engines in the Sherman, Texas, Central Station..... 169
The Plant of the Great Northern Power Company, of Duluth, Minn. By F. M. Feiker..... 171
The Effect of Diffusing Reflecting Coatings on Glass Prismatic Reflectors. By Major E. L. Zalinski..... 174
Load and Power-Factor Relations in Two-Phase to Three-Phase Transformers. By F. A. Fish and Adolph Shane..... 175
The Elevated Conductor in Wireless Telegraphy. By H. J. Round.... 176
Electric Coffee Roasting in Germany..... 177
New Telephone Patents..... 178
Letters to the Editors:
Pike's Peak Hydro-Electric Plant. By G. A. Taff..... 180
Measurement of Induction Motor Slip. By Frederick E. Meurer... 180
The Simplon Electric Locomotives. By G. Leve..... 180
Digest of Current Electrical Literature..... 180
Book Reviews 183
Pike's Peak Hydro-Electric Plant..... 184
New York Central Locomotives..... 185
"Victor" Combination Meter..... 185
Exhibits at the Contractors' Convention..... 186
An Isolated Plant in Milwaukee..... 187
Industrial and Commercial News..... 188
General News 191
Weekly Record of Electrical Patents..... 197

Oil Engines for Electrical Generation.

That oil engines can be successfully used in central station work is not a new discovery, but the description elsewhere of a Texas plant employing this prime-mover is of particular interest on account of the rather full data given as to cost. When a fuel bill can be reduced from $600 to $95 per month by a change from the steam engine to the oil engine, the case is indeed one meriting careful attention from central station men in sections where fuel oil is cheap. Of course, the price of the oil in the present instance is ridiculously low—2 cents per gallon at the plant—but on the basis of fuel cost alone there would, according to the figures given, be a saving even with oil at 12 cents per gallon. In addition to the data given in the article it would be very interesting to have a statement for an oil engine plant of considerable size, giving the labor cost and the costs incident to the compression and cooling system. Then a complete comparison with a steam plant would be possible and the economic limiting cost of oil for any given case could be determined. The showing at Sherman, however, is still another indication that the steam engine has before it a battle with the internal combustion engine for very existence. As a heat engine the latter has from the beginnings of thermodynamics been conceded superiority over the steam engine in any form, and as a machine it is now rapidly reducing the gap between its practical and ideal efficiencies.

Load and Power-Factor Relations in Two-Phase Three-Phase Transformers.

It is well known that when a pair of transformers have their primaries excited from two-phase mains, while their secondaries, with appropriate numbers of turns, have the end of one joined to the middle of the other, the three remaining secondary terminals will maintain three-phase e.m.f's. It is also less generally known that when the three-phase secondary load is balanced and has a given power factor, the loads on the two primaries are also balanced with a like power factor. The proof of this proposition is presented geometrically in an article by Messrs. Fish and Shane on page 175 of this issue, for the case of a delta secondary load. It is perhaps a little less simple for this case than when the load is connected in star. Of course, if the three-phase secondary load be unbalanced, the two-phase primary load will also be unbalanced, and the dissymmetry in the two will be different. As a rule the dissymmetry is greater in the primary than in the secondary system in such a case. The article is clear and definitely expressed. In many vector demonstrations there is looseness of expression in regard to the directions of vector e.m.f's and currents.

A point not always recognized in connection with such transformers is that if both have the same corresponding sizes of wire in primary and secondary windings, the transformer with the shorter secondary will be overheated with respect to its neighbor, on balanced load. It will also have 13.4 per cent less copper in the secondary winding. If, however, the cross-section of the secondary conductor be increased by this amount, so as to restore

equality of secondary winding weights, the heat in each transformer will be the same under balanced load. An essentially equivalent demonstration of these propositions is capable of being made by reference to the primary system alone, if three-phase mains be connected to star windings and the neutral point be shifted dissymmetrically. The two-phase-three-phase transformer has proved its utility in bridging over from one of these systems to the other. In other words, it enables two unlike systems to be operated together. But there is no inherent advantage in transferring from one system to the other. If the generators in a system are wound three-phase it is better to keep everything three-phase. There would be no benefit derived from the selection of two-phase motors for the mere joy of supplying them through three-phase-two-phase transformers. On the other hand, if the generators are two-phase, there is a copper saving demonstrable in three-phase line over two-phase transmission provided that the dielectric strength of the transmission lines is measurable by the voltage between adjacent lines and not by the voltage between any one and ground. In such cases it is usual to install two-phase-three-phase converters for the economy in line copper. It is perhaps a question whether in some transmission lines the stress is not from line to ground rather than from line to line. In such cases the alleged saving in copper of the three-wire over the two-wire system is called in question.

The Rousseau Diagram Versus Polar Photometric Curves.

The article printed elsewhere in this issue on the effect of reflecting coatings on prismatic reflectors by Major E. L. Zalinski, while written primarily to bring out the difference between white enamel-coated and uncoated glass prismatic reflectors, also touches on another point which beginners in the study of illuminating engineering should always bear well in mind, namely, that the area of a curve plotted to polar co-ordinates giving the distribution of light in a vertical plane through a lamp, does not represent the total flux of light obtained from the lamp. If this were true, we could by using reflectors obtain increases in efficiency of some hundreds per cent. The polar curve for a bare incandescent lamp, for example, is a very small and insignificant affair as compared with the polar curve for the same lamp equipped with a concentrating mirrored reflector. The Rousseau diagram mentioned in the article is easily plotted from any form of photometric curve, and when once plotted it represents at once graphically the value of the total useful flux of light in various directions from the source. If the curve given in Major Zalinski's Rousseau diagram relating to a given type of lamp were compared with the polar photometric curve of the same lamp, the high candle-power in the polar curve within 30° of the vertical, while making a big showing and being of considerable importance in many cases, nevertheless occupies a relatively small area on a diagram truly representing the total useful flux of light. This fact, of course, accounts for the enormous increases in tip candle-power which are obtainable by the use of concentrating reflectors. A very little light borrowed by a reflector from near the horizontal may be made to cause an enormous increase in the tip candle-power.

Power Transmission at Constant Current.

We find in a recent number of *La Revue Electrique* an interesting paper by M. Rouge, abstracted in the Digest, dealing with the comparison of constant-current and constant-potential methods. It has been rather the custom among engineers to turn down the former quite off-hand almost with contempt. Yet it is a fact that much important work by this method has been done and is to-day being done abroad, so that it should not be treated so cavalierly. M. Rouge takes up the general comparison with entire fairness and discusses it at some length, finally reaching the customary result on finding the constant current faulty in the work of distribution, but entirely feasible for the delivery of power *en bloc*. The recent discussions about the Victoria Falls power project have brought constant current again to the fore, and all of the recent experiments which have been reported tend to establish the validity of the theoretical conclusion that insulation for a given high-working voltage is much more easily carried out at constant current than by the customary methods. It is well established that the striking distance, which is the critical factor in insulator design, depends on the maximum difference of potential and hence for given working voltage is only about two-thirds as great for constant direct current as for alternating current of any kind.

With porcelain insulators at least, there is no such electrolytic tendency as would tend to compensate for this difference by making insulation more difficult; and with direct-current, strains due to resonance are absent, although it is not safe to assume that surging would disappear entirely. Yet the chance of its occurring in serious form is reduced, and taking it all in all, it must be admitted that considering merely the possibility of insulating very high voltages, the constant-current system has much the better of the argument. Granting this, one is still far from a conclusion favorable to the system unless it also appears that voltages commercially necessary for great transmission enterprises cannot be insulated when using alternating currents. In other words, if it is necessary to use 200,000 volts for a certain transmission, is that pressure impossible with polyphase lines and possible at constant direct current, or is the question only one of putting a considerable investment in insulation instead of in the somewhat intricate equipment of a constant-current station? After all, it is a problem of dollars and cents. A constant-current generator may, for instance, be produced for 5,000 volts and 200 amp., although nothing so effective is now known. Assuming a plant of 50,000 kw, would it be cheaper to use 50 such machines with their intricate regulating system or to install, say, five low-voltage, 10,000-kw polyphase generators with high-tension transformers and insulators?

So far as generators and transformers are concerned, the alternating-current system would have a very large balance to its credit, a part of which could go into the insulation. There are no available data to determine the extra cost that would here be necessary. With long-span construction the difference in plant cost would cover a large difference in insulators. Allowing the polyphase system, say, 30 insulators per mile, a line 500 miles long would have 15,000 insulators. The constant-current line would have 10,000. If the former cost $10 each and the latter $5 each, the constant-current system would be $100,000, or $2 per kw to the good, a difference that would not begin to pay for the difference in plant cost at any figures in the least plausible. It is clear that the constant-current system must show an overwhelming difference in facility of insulation to compensate for its plant, subdivided as it is into many small high-tension units, driven by correspondingly small prime-movers, if any simple arrangement be followed. Until the upper limit of in-

sulation in an alternating-current system is reached, it would, therefore, seem hazardous to trust too much to the constant-current system in anything like its present shape.

THE THEORY OF BENT WIRELESS TELEGRAPH OSCILLATORS.

There are various types of antennæ, or vertical conductors, known to the wireless telegraph art. We have the plain vertical rod, the vertical cylinder, the harp, the umbrella, the inverted cone, and the barrel types. All of these types serve their purpose, at the expense of the landscape, in various parts of the world. In the dim and remote antiquity of wireless telegraphy—say ten years ago—we used to have the horizontal cylinder or rod. This was given up, for several reasons. In the first place, the emitted wave had a polar or neutral axis in line with the axis of the horizontal rod, and in the second place, the range of transmission was relatively small, owing to the constant dispersion of energy by reflection at the earth's surface. That is to say, the emitted wave was dissymmetrical in intensity, being nil along the line of the rod, and it was also relatively weak at long distances. Recent efforts have been made to develop a directive antenna, or an antenna that would throw its energy into a horizontal beam, instead of scattering it to every direction in space over the earth. These efforts have led to mounting a horizontal antenna on top of a vertical in the manner which we have seen used on some vessels for several years; that is, the antenna first runs straight up a mast, and then is carried horizontally in the space between that mast and the next. An article, noticed in the Digest, upon the mathematical theory of this type of bent or jointed antenna, by Dr. J. A. Fleming, has recently appeared in the London *Electrician*. This article deals with the problem by considering the electromagnetic actions in free space remote from the earth, when a rectangular frame oscillator is used with one side wanting. The result shows that at very great distances from the sending station the dissymmetry will be inappreciable. As the distance from the sending station diminishes, the dissymmetry increases so long as we keep at least several wave lengths away. The wave will be least intense broadside on to the horizontal part of the antenna, and will be most intense in the direction opposite to that taken by the horizontal part.

The same result can seemingly be reached by considering the vertical and the horizontal portions of the bent oscillator each to send out an independent train of waves, the two sets of waves being, however, superposed, and of the same length, differing definitely in phase. The poles of these two waves will be crossed and the waves from the vertical portion will persist at great distances, after those from the horizontal have died away. Consequently, for short distances, a distinct dissymmetry in distribution can be produced, but for very great distances it does not appear that the waves would be more intense in the most favored direction than they would be if a vertical antenna only were used. So far as concerns wireless telegraph operations at sea, it is important that the oscillator or sending antenna shall emit symmetrical waves, or radiate equally in all directions. It becomes, however, very desirable to be able to locate the direction in which the waves are coming from some distant vessel or shore station, without having to stop and swing the ship, or change the course, in order to do this. A practical bearing indicator of the invisible sending station would be a great boon to the mariner. By its aid it might be possible for him to locate his vessel in motion by bearings of lighthouses equipped with antennæ, when his distance from them was far beyond that of ordinary lighthouse visual range. Such a method might be of immense service to navigation.

FUSES ON SECONDARY CIRCUITS.

There seems to be considerable difference in practice and experience among companies operating alternating-current distribution systems of sufficient size to admit of several transformers feeding into the same secondary network. It is the practice of some companies to connect all the transformers directly to such secondary networks, using fuses on the primary side of each transformer only. Another common plan is to divide the secondary network into sections, each section being fed by a transformer at its middle point; these sections are then connected together midway between transformers by means of fuses, which usually have from 30 to 50 per cent. of the carrying capacity of the transformers connected to the network. The object of such fuses is, of course, to prevent a short-circuit on one portion of the secondary network from interrupting service on the whole network. With this latter arrangement, if a short-circuit occurs on any section, the primary fuse of the transformer feeding that section will blow and will be at once followed by the fuses connecting this section with those adjoining; thus, the short-circuited section will be cut out without interrupting service on the adjoining sections. If fuses between sections are not employed, a short circuit at one point on the network immediately overloads the transformer nearest the short circuit sufficiently to blow its primary fuses. This is likely to be followed by the blowing of the fuses of all the other transformers connected to that network, and every fuse that blows increases the certainty that others will blow. With modern substantial secondary network construction, short circuits between transformers and customers' service fuses are rare, so that this consideration is, perhaps, not as important as it might seem at first.

It is important, however, to consider the effect of overloads at any point in a network. If an overload occurs at any point in a network and it is sufficient to blow the primary fuses of the nearest transformer, the chances are altogether in favor of its blowing the fuses of all the other transformers feeding the network, for the reason that the overload will probably occur at a time when the other transformers on the network are carrying full load. A fuse blowing at one point is thus likely to involve the whole network before the trouble is over, and it is then a slow and tedious job to get service restored on the network. To be sure, plenty of plants are operating and giving satisfactory service without sectioning their secondary network in the way indicated. That more trouble is not experienced is probably due to the fact that transformers are either very much overfused, or that they are considerably underloaded. Where secondary mains are not continuous for several blocks, the question of connecting more than one transformer to them does not come up. When, however, the load is sufficiently dense to require secondary mains to be run for several blocks, the only reason that can be advanced for not connecting them together into one continuous system, or netwark, is that by such a connection trouble on one part of the network is likely to spread to other parts. The practice of placing fuses between sections seems to be a happy compromise by which the transformer feeding one section can help its neighbors, and the full value of the copper in the secondary mains can be obtained without really sacrificing anything in reliability.

Limiting the Generation of Niagara Power.

Last week we made note of the hearing before Secretary of War Taft as to permissions to develop Niagara power and use the water of the cataract. Secretary Taft has now announced his decisions. Under the law enacted at the last Congress for the preservation of the scenic beauties of Niagara Falls the Secretary of War has the authority to grant permits to the extent of withdrawing from the river 16,500 cubic feet per second. Last week the Secretary heard the statements of the several companies interested, and it is now announced that temporary permits would be granted, as follows: Niagara Falls Power Company, 8,600 cu. ft. per second; Niagara Power Company, 4,000 cu. ft. per second; Lockport Hydraulic Power Company, 500 cu. ft. per second from the Erie Canal and 333 cu. ft. from the lower level of the canal at Lockport.

The Secretary expresses the opinion that the use of water from the river by the Albion Power Company does not fall within the law, and for the present he has withheld his decision concerning that company. He has also decided to postpone consideration of the application of the Niagara Falls Trust Company, as executor of the estate of Henry E. Woodruff, deceased, giving as his reason that water is not being used by the company.

His decision permits the Niagara, Lockport and Ontario Power Company to import into the United States from Canada the equivalent of 25,000 hp from the Ontario Power Company of Canada, and the Niagara Power Company is also authorized to import from the Canadian Niagara Power Company not to exceed 25,000 hp daily.

These two permits are the only ones granted for the importation of the electricity generated in Canada. The Secretary says that it will be necessary to make a thorough investigation before granting permanent permits to the two companies. He has designated Capt. Charles W. Kutz, of the Corps of Engineers, to make a full report on the Canadian power, and when it is submitted the report will be laid before the International Waterways Commission.

The Public Ownership Inquiry Abroad.

Note has been made in these columns from time to time of the progress of the investigation of the Commission on Public Ownership and Operation of the National Civic Federation. Fifteen members of this Commission have been in Europe since May and so far have made studies of street railway systems, electric light and gas plants and other publicly owned utilities, principally in England. Upon the Commission's return to the United States in August its investigation of different cities in this country will be continued. In describing the methods of the Commission, Prof. Goodnow, of Columbia University, who is the chairman of the Investigating Committee, says:

"Those responsible for the management of the National Civic Federation laid down one fundamental rule which those of us who have been most active in the work of investigation have had continually before us. The rule was that we were to ascertain facts. The adoption of this rule prevented. in the first place, this Commission from meeting and after argument and discussion coming to a determination that, in its opinion municipal ownership and operation of any specific public utility under the conditions existing in the average American city was better or worse than private management. The opinions of this Commission, however valuable they may be, are not facts.

"We are confined to facts. Now, what are facts? What are the facts of municipal ownership? Not knowing much about the facts of municipal ownership except that, like other facts, they were, presumably, stubborn things, the first thing which we did in order to do the work committed to us was to devise methods by which these facts might be ascertained. We determined that they could be ascertained only through the examination of specific plants and, inasmuch as the means at our disposal were limited, by the examination of selected plants. Now, some municipal and some private plants had a general reputation of being successful. Some, on the other hand, were reputed to be unsuccessful. If we should choose all the alleged successful municipal plants and should set them off against the alleged unsuccessful private plants, or vice versa, we should certainly obtain a conclusion of facts—choice facts, they might be called.

"But such a method of ascertaining facts we had certainly to avoid. I should not have said we had to avoid this. All necessity for avoiding it was removed by the wise action of the National Civic Federation, which so constituted the Commission that almost every shade of opinion and almost every interest or prejudice was represented on it as well as on the smaller committees which have had the burden of superintending the work of investigation. The result was that when it came to choosing the particular plants to be examined, opportunity was open for making any objection which could be made to a selection, because of the fact that it was unrepresentative or incomparable with other selections. Indeed, the places selected have been selected as the result of unanimous action on the part of the committees in charge of the work. It was in this way, then, that the attempt has been made to secure a fair selection of the places from which our facts were to be ascertained.

"After the places to be examined had been selected, the question presented itself as to what things we should look for in these places. We soon found that these things might be grouped under one of four heads: (1) Character of service; (2) Financial results; (3) Political conditions; (4) Social conditions, particularly labor conditions.

"Having determined that what we wished was to be found under one of these heads, we had to decide how we would actually get at the facts. We very soon determined that we must have for this purpose men who by education were qualified to do the work, and we therefore selected four classes of experts, viz.: Engineers, accountants, those acquainted with labor conditions and those who by training and experience were able most easily to get information with regard to other social and political conditions. In the choice of these gentlemen we have been most fortunate. We did not select any one who was not accepted without objection by every member of our sub-committee. We endeavored, furthermore, to get absolutely the best men available, and we found in these gentlemen a willingness, when they learned of the paucity of our resources, to forego a part of the charges which they usually made for work of this sort. The experts whom we have selected have been engaged, some in England and some in this country, in acquiring the information desired, which will be submitted to the members of the committee before they are called upon to state their conclusions."

Programme for Ohio Electric Light Association.

The twelfth annual convention of the Ohio Electric Light Association is to be held at Hotel Victory, Put-In-Bay, on Tuesday, Wednesday and Thursday, August 21, 22 and 23. The following are some of the topics upon which papers will be presented: Natural gas engines in competition with electric motors. What inducements should be given to increase business in villages or small cities in which the population is not increasing? Description of wiring of a moderate-priced residence scientifically lighted. Progress of high efficiency lighting unit in Ohio by central station men. New business, how to get it and how to keep it. One successful way to get business. Legislation, its uses and abuses. Report of committee on cost determination. Report of committee on publicity. Luminous arc lamps with mercury arc rectifiers. Electric heating and cooking devices (illustrated lecture). Notes on high efficiency lighting units by the manufacturers and wiring for electrical appliances, other than light.

On some of these subjects as many as four papers will be presented. An urgent invitation is extended to the ladies to attend this convention, particular attention having been given to their entertainment. A large number of prizes have been donated for distribution among the ladies attending, and there will be the usual amount of entertainment.

Annual Convention of the National Electrical Contractors' Association.

THE National Electrical Contractors' Association held its sixth annual convention at the Hollenden Hotel, Cleveland, Ohio, July 18, 19 and 20. On the 17th the Ohio State Association held its annual meeting and election of officers, which resulted as follows: Amil Grah, Cleveland, president; Patrick McNairey, Cleveland, vice-president; Richard Stites, Columbus, secretary; W. G. Ruder, Cincinnati, treasurer; M. W. Hansen, Toledo, committeeman to the National Convention. It was decided to hold the next semi-annual meeting of the State Association on January 10, 1907, at Canton, Ohio.

Contrary to the usual practice, the morning sessions of the convention were open to guests as well as members, and at these meetings a number of interesting papers were presented. In the absence of Chairman F. C. Werk, of the Cleveland committee, Mr. A. Oppenheimer, secretary, made the address of welcome at the first open session. He outlined the plans for the meeting and the entertainments that had been provided, and dwelt at some length upon the importance of Cleveland as an electrical center.

Hon. Tom L. Johnson, Mayor of Cleveland, welcomed the association in the name of the city. After a few happy remarks the Mayor said he was going to take this opportunity to tell the electrical world all about his new distance-annihilating invention on which he is said to have been working for some time past. The newspapers had tried to illustrate his invention, but any one could see that the machine as they had described it was impractical. He had decided that the 18-hour train from New York to Chicago was altogether too slow, and he proposed with his new car to shoot over the route in one hour. He thought it probable that they would be able to make a run from New York to San Francisco in three hours. It takes the sun something like four hours to go that distance, but that he believed his invention would beat the sun. He said the mechanical part of the car had all been worked out, but that he had some doubts as to what effect the air friction would have on the front of the car; whether it would melt it or form icicles; whether it would be deviled or frappéd. He got down to an interesting point in his description of this wonderful machine when he said that he had received a call from a man at his office who wanted to buy the invention, and that he would have to leave the rest of the description for some other time, and that the best he could do was to leave the members the keys of the city.

Mr. Ward B. McAllister, president of the Cleveland Builders' Exchange, welcomed the attendants on behalf of that body. He described some of Cleveland's fine buildings and spoke of the group plan of the public buildings now under way, which he said would show some interesting developments in the way of architectural design and illumination. He invited the attendants to visit the fine quarters of his organization.

Mr. C. M. Lawton, the Ohio State director, a Cincinnatian, relieved his feelings by calling Cleveland a nice little burgh, and a meal station on the way from New York to Chicago, displaying the sentiments usually shown by a citizen of Cincinnati, whenever he speaks of the larger and more progressive city on the lake.

Mr. James R. Strong, national president, replied to the welcoming remarks by dwelling upon the importance of Ohio in the National Association. He went into the history of the organization saying that the little band of organizers had grown until the association had become a power in the trade and an organization which was respected. He said that the policy of the association was to build up and not to tear down. The chief aim was to stop ruinous competition and to secure uniform action between the manufacturers, the jobbers and the contractors. It was not the aim to extend the field of the contractors into the province of others, but simply to secure and hold their share of the business and to get a reasonable profit on work done.

Mr. S. C. Dickey, of Indianapolis, president of the Winona Trades School, of Indianapolis, made an eloquent plea for the co-operation of the association in the training of young men to become skilled workmen, saying that the future development of the country depended upon the educating of boys in various branches of trade. He said that while the technical schools were doing a grand work in producing engineers and experts, the work of producing ordinary skilled workmen was being neglected in this country. Germany, France and other European countries are giving this subject much attention, and the crops of trained workmen which are being turned out in their schools is bound to improve the chances for commercial supremacy by these countries. As an example of the surprisingly small proportion of men who are given a higher education in this country, he said that the number of pupils who entered the primary schools annually was about 5,300,000. About 2,500,000 go through to the fourth grade, while only about 300,000 enter high school. The total entering colleges, business schools and technical schools was only 116,000 and only a very small proportion of this number were learning trades.

The Winona Trade School has recently purchased the old government arsenal at Indianapolis with 80 acres of ground in the heart of the city and buildings which cost over $600,000. Among its various classes are those covering lithography, foundry work, tile work, tailoring and molding. Students in these classes are always sought for by manufacturers and in many cases they are induced to leave before they finish the courses by promises of good wages. An electrical worker's department recently formed has 48 students and Mr. Dickey asked the association for suggestions as to what particular branches of the work and what method should be followed in this course. The school is unique in that while it is heavily endowed, there are no free scholarships for charity students. Scholarships are loaned to the young men who give their notes without interest and pay for their education out of their first earnings. Touching on the subject of unionism, Mr. Dickey said that students were free to join unions if they desired, but that the curtailments as to apprentices and the production of new workmen made by many of the unions seem to discourage students from labor organizations. They have frequently been approached by labor organizers to secure their co-operation in the unionizing of the students, but they were adverse to any such steps, believing that the country would ultimately be placed in great peril unless workmen were permitted to follow their own ideas on this subject. His comments on the open shop won the approbation of those present.

Mr. Frank A. Pattison, New York, gave an address on the subject "Liberty and Organization." He said that while man naturally lived in an atmosphere of competition and the idea of freedom of action was constantly becoming stronger, yet the idea of organized effort was also gaining ground. He believes it possible for liberty and organized effort to live together smoothly, but when friction arises in an organization, progress ceases. In spite of the recent exposes through the newspapers and investigations, he believed that the idea of honesty was gaining ground. The revelations indicate, not that there are more dishonest people than formerly, but that the dishonest people are being found out. Viewing the American Electrical Contractors' Association as an outsider, he believed that the quality of its membership was improving, and that while the organization was stronger than ever before the members were paying more attention to the rights of their associates and to their duties toward their customers. He advocated that the association take steps to remove from its ranks any contractors found guilty of dishonesty or shoddy work. He urged members not to undertake work which they did not know how to perform, or which they did not have the finances to carry out. While it was not possible for all to perform the more difficult classes of installation, it was possible for all to do the same grade of work, and he suggested that the membership be graded and classified so that the members in different classes would be authorized to take care of different classes of work. He thought that the great trouble with labor unions was that they attempted to grade all men alike, and, by so doing, the skillful workmen suffered at the hands of the inexperienced and careless men. When an association member undertakes to make money on a job without regard to the quality of his material or the character of his work he makes trouble for all who are associated with him; and a concern of

this character is a traitor to the association and should not be countenanced. "A man who makes things and sells them is a useful man, but a man who sells things and won't stand back of them is a useless man. Each member should state the material and grade in making a bid for a contract and the local organization should insist that the members carry out their agreements to the letter. The association should discourage the manufacture of shoddy materials by censuring members who purchase them." The question of delivery was even more important than the question of price, and the association should also see that members live up to their delivery promises. Attention to these matters would improve the relations between contractors and customers which at present are not what they should be.

He touched on the rebate question by saying there should be a rule against a contractor accepting a rebate from a manufacturer and that all dishonest dealings and underhanded methods should be halted by the organization itself. In brief, the organization should stand first for high-grade membership; second, for more co-operation and fewer attempts to gain advantage over other members; third, graded membership and small organizations for controlling certain classes of work, and fourth a code of contracting ethics, which should be based upon the Golden Rule.

At the open session Thursday morning Mr. J. Robert Crouse, of the Co-operative Electrical Development Association, outlined at considerable length its plan for profitable commercial co-operation in the electrical industry, reading a paper which he presented before the National Electric Light Association at its 29th convention held at Atlantic City, June 5-8, 1906. This paper was covered quite fully in the Electrical World at that time In prefacing his paper Mr. Crouse said that this plan had been formed in embryo about two years ago. The lamp company with which he was associated found that in 1905 the increase of lamp consumption in the entire country had been but 4 per cent, and in 1906, 5 per cent, whereas previous to that time the increase had ranged from 8 to 10 per cent, and in some years even more. The original plan for co-operative development contemplated only a unanimous movement on the part of the incandescent lamp manufacturers, but careful study of the subject convinced the organizers that the other branches of the industry bore an interdependent relation to the consumption of incandescent lamps. The increased consumption of incandescents went to increase the peak loads and whereas the lighting plant operators wanted this business they were more desirous of business which would improve the power factor. As an improved power factor meant a reduction in rates, it would indirectly result to the advantage of the lamp manufacturers through the increased consumption of lamps. It was, therefore, decided to interest the other branches of the industry in the general movement. Relative to the work already accomplished by the organization which he said was still in its infancy, Mr. Crouse stated that literature to the amount of $3,000 per month was being sent from the central bureau. Since February 1, 1906, over 100 central stations have contracted for advertising literature with various advertising agents to the amount of over $125,000. From the results already obtained, it is estimated that it costs from 18 to 25 cents in advertising expenses to secure the installation of one 16-cp lamp, and that this expenditure had resulted in approximately 500,000 incandescent lamps being installed, equal to 38,116 hp of generating machinery, which meant a corresponding increase of business for jobbers and contractors as well as the engineers. By January 1, 1907, a quarter of a million dollars will have been spent in this missionary work with a proportionate increase of equipment needed to handle it.

Mr. Crouse was aided in his dissertation by a large chart to which he made frequent reference. It was shown that there was no uniform development of central stations. Some stations have developed to a point where they have wired the equivalent of two 16-cp lamps per inhabitant and have a revenue of $3 to $4 per capita. Others in towns of similar size have but one 16-cp lamp to every ten inhabitants and have a revenue of less than 50 cents per capita, the difference being very largely a matter of advertising and solicitation of business.

Mr. Crouse said that at recent meetings of the National Electric Light Association and the Electrical Jobbers' Association these organizations had defined their attitude toward the movement by the appointment of committees of three representing the various sections of the country to co-operate with the development association, and he urged that the contractors take similar action, in order that their position might be defined.

Mr. J. H. Montgomery, of the National Electrical Inspectors' Association, spoke on the "Inspector's Point of View." Recently formed, the Inspectors' Association aims to eliminate many of the troubles of the contractors by securing a uniformity of rulings. He said this was a difficult proposition on account of the different conditions in various places and the various kinds of materials used for the same purpose, but he thought that the association would accomplish much good in the direction mentioned.

Many of the complaints against the apparently unreasonable rulings of the inspector are due to the different points of view of the various parties concerned. The manufacturer's interest extends only where his goods are installed. The architect desires to secure satisfactory operating results and usually at the lowest possible cost. The central station man regards new work as something to "hitch up" to. Many central station men do not care what they hitch to so long as it uses current, although in a general way they want good construction. The contractor says: "Will the job pay?" Some contractors take an honest pride in good work, but there are too many who aim simply to put the wires in at the lowest possible cost and have the work covered up as quickly as possible. The owner is about the only one who sees the work under operating conditions. His main idea is to have it practical and devoid of trouble-giving qualities. The owner should get good value for his money. The inspector has, or should have, no financial interest in the job and his duties are to decrease the fire hazard and the possibilities of accidents. He must be equipped in education and backbone to withstand the assaults of any and all of the interested parties referred to.

"Public opinion at the present time is in somewhat of an amusing condition regarding the possibilities of fire from imperfect wiring. The majority of people don't see any danger in wires of any kind and class them all alike, while another large class look upon any sort of a wire as bearing a close relation to dynamite. The average citizen will tell you that the wiring in his place is all right until there is a fire or some one gets hurt, and then he blames the inspector.

"There is a chance for a broad field of education in teaching the public the dangers of improper wiring. In plain non-technical language the importance of safe work should be spread broadcast through the daily papers. We know and you know what kind of material should be used, but the public don't know much about it and should be taught; in fact, I am in favor of alarming the public against poor wiring. Reputable contractors should refuse to undertake work where it is necessary to use material which is unsafe and not durable. Contractors should refuse to buy switches which arc unduly, sockets which will not resist wear and tear, rheostats which heat up, and insulation which is insulation in name only."

Mr. Montgomery thought it would be well for the association to have a laboratory to make tests on all kinds of material and to sift out the good from the bad, thus obliging manufacturers to use proper material and workmanship in their goods. He favored the scheme of licensing contractors. He found many so-called contractors who did not have the first conception of safe and reliable work and he mentioned several instances of careless and ignorant workmanship which greatly amused his auditors.

C. J. H. Woodbury, engineer for the American Telephone & Telegraph Company and secretary of the committee on standard wiring rules, gave an interesting talk in which he incidentally touched on the tremendous growth of the Bell system and then gave an outline of the wiring code. He said that the transmission of speech on the Bell company's wires represented a saving in traveling of 30,000,000 miles per day for local exchanges and 45,000,000 miles per day for long-distance service, and probably not far from 100,000,000 miles per day for all messages, including replies. This great saving in traveling liberated an enormous amount of time for other labors and he believed that the telephone more than any one thing was responsible for the tre-

mendous development of this country during the past few years.

Speaking of the standard wiring code, he said that in 1881 when the telephone and other applications of electricity were just coming into use in the business world, he was an inspector for the Factory Mutual Fire Insurance Companies of New England. In six months out of 65 electrical installations in textile factories, 23 disastrous fires resulted. He and his associates immediately began a series of experiments with Mr. Charles F. Brush and other prominent electricians and as the result of these experiments they formulated a code of wiring rules which was the foundation of the present code. So far as he was aware, from that day to this the Factory Mutuals of New England had never lost a dollar through defective wiring.

Gradually other codes were introduced until the electrical interests became badly hampered through a great confusion of contradictory rules. In February, 1896, a meeting was held in Cleveland at which a committee was appointed to bring together the manufacturers, the contractors, the underwriters, municipal inspectors and others interested, and after a careful study of the English, French and German codes, together with the best ideas of this country, the National Electrical Code was finally compiled. At that time the code seemed to cover all the requirements, but since then the insurance people have gradually added to it until at present the code has grown from 80 to 162 pages. The various organizations, however, have not accepted many of the additions, until at this time the code again threatens to become a mass of puzzling inconsistencies with many contradictory clauses. He believed that the time had arrived when all the interested parties should be gotten together and the code revised again. He felt that while the wishes of the insurance people should be considered as far as possible, the underwriters should treat the matter in a judicial manner, and that the revised code should be one which would work to the advantage of the greatest number of interested parties.

National Treasurer J. R. Galloway, of Washington, D. C., made the closing address of the open sessions, going first into the history and growth of the association and then giving much good advice as to the work to be done in the future. The association was formed at Buffalo, July 17, 1901, with an initial membership of 31. Through the earnest efforts of the officials and members, this number had grown to 610, representing the cream and might of the industry, with members in every State in the Union. While a tremendous amount of good had been accomplished, there are many things yet to be done before the members realized the full fruits of the organization. He urged absolute co-operation among the members and a closer community of interests between the various branches of the industry. In no uncertain terms he expressed the opinion that although the contractors were responsible for a large proportion of the tremendous growth of the industry, they were not receiving profits commensurate with their efforts.

Practical results along these lines could only be accomplished through a plan for licensing and grading contractors. The honest and reliable contractor had nothing to fear from such a plan, and he urged the members not only to work for legislation to this end, but for legislation providing for standardization of existing codes and for uniform enforcement of the codes. In closing he said: "The underwriters and municipal authorities are beginning to realize that we are honest in our desires to better the conditions for all, and in return we should be granted a revision of the code and a uniform interpretation of its rules."

Following the custom which has been in vogue since the organization was formed, the entire list of national officers was reelected for a second term. The officers are as follows: President, James R. Strong, New York; first vice-president, W. I. Gray, Minneapolis; second vice-president, Walter C. McIntyre, Philadelphia; third vice-president, F. E. Newbery, St. Louis; treasurer, John R. Galloway, Washington; secretary, W. H. Morton, Utica, N. Y.; sergeant-at-arms, J. C. Stearns, Buffalo; master of transportation, Alexander Henderson, New York.

The next meeting of the association will be held in New York City. The executive committee arrived at this decision after long deliberation. This announcement was a great disappointment to delegates from Minneapolis and from Norfolk, Va., both places making strong bids for the meeting. The invitation of the former was turned down because it was desired to hold the meeting in the East, while the bid from Old Virginia was denied because it was considered inadvisable to repeat the experience of the St. Louis meeting, where it was found almost impossible to get the members together because of the counter attractions offered by the big fair. Norfolk was represented by a party of ten boomers headed by President H. M. Brown, of the Virginia State Association, whose arguments as to the attractions of the coming exposition, in view of past experiences proved their undoing.

The Ohio State and local committees, headed by F. C. Werk, president, and O. Oppenheimer, secretary, did themselves proud in the matters of arrangements and entertainments. At the last moment Mr. Werk was kept away by severe illness, much to the regret of everyone, which resulted in Mr. Oppenheimer doing double duty, and it is literally true to say that he was "constantly in evidence," night and day. The entertainments were varied and lavish. They included a lunch to the national officers as guests of the Ohio association; a reception, luncheon and trolley ride for the ladies on Tuesday; luncheon and theatre party to the ladies on Wednesday; an automobile trip and dinner for the ladies Thursday afternoon, followed by a banquet in the evening for the members and a trolley ride to Luna Park, and entertainment for the guests. Friday, the 20th, was devoted entirely to a delightful all-day excursion by steamer to the famous Lake Erie resort, Put-In-Bay, a beautiful island 65 miles from Cleveland, and the scene of Commodore Perry's great naval victory over the British. A fine dinner was served en route with a light luncheon on the return trip.

Badges were issued to nearly 175 active members and to about 200 guests, including the ladies. The central location of Cleveland and her many natural attractions caused more than the usual number of members to bring their wives with them. Those who had not visited the city before were agreeably surprised at the beauties of the streets, parks and boulevards, of the city which is often referred to as the "next to the smokiest city in the country." Thanks to the liberal adoption of smoke-consuming contrivances and an energetic health department, it is fast losing this odious reputation. Three carloads of members and guests arrived from the East over the New York Central Lines in fine Pullmans, which were attached to the Lake Shore Limited, arriving in Cleveland early Wednesday morning. As usual, it comprised a jolly, not to say hilarious party, to the majority of whom the sleeping car berths were useless adjuncts. Mr. Alex. Henderson was the efficient master of transportation.

It was reported that the fifty or more ladies attending the meeting held a quiet session and formed a ladies' auxiliary of the Electrical Contractors' Association, the chief aim of the organization being to make a concerted demand that all its members be permitted to attend future gatherings of the main organization. This was merely a matter of report, however, for like the national organization, the members declined to give out any information as to what took place at the "meetings for members only."

Although no exhibits of manufacturers were arranged for, a number of leading local and out-of-town concerns had parlors adjoining the convention hall where they entertained, and in a few cases displayed samples of their goods. Some of these exhibits are referred to in detail elsewhere in this issue.

Badge of Illuminating Engineering Society.

The Illuminating Engineering Society is now issuing to members a badge designed by Mr. Waldo S. Kellogg, member, and represented in the accompanying cut. The material is 14-karat gold, with a central field in blue enamel. Each badge is numbered and registered in the name of the member receiving it, and is issued with the express condition that if the member resigns or is dropped from the Society, he shall return the badge, receiving therefor $2.00. The price of the badge to members is $3.00.

With the Combined Electrical Engineers in England.

By C. T. Wilkinson.

The Lake District.

On Sunday, July 1, one of the most enjoyable excursions of the trip, whose earlier stages have already been noted, took place. The entire party left Manchester at 8.55 a.m. by the special train which accompanied them throughout the tour, arriving at Windermere at 11 a.m., where coaches were taken to Grasmere in the famous lake district. The drive was along the shore of Lake Windermere through Ambleside, lunch being taken at the Prince of Wales Hotel, where as usual elaborate preparations had been made for the comfort of the visitors. After lunch a small party started ahead intending to walk across country to rejoin the main party at Keswick. The drive from Grasmere to Keswick, passing through the Vale of Thirlmere, was greatly appreciated and the magnificence and beauty of the scenery called for continuous comment. On arrival at Keswick about 5 p.m., a pleasant surprise was given the party through the kindness of the Vicar, who had prepared tea for the entire party in a large hall and had arranged to have the museum and other places of interest specially thrown open for the rest of the evening. A large number of the party also adjourned to Lake Derwentwater, and taking boats spent the time enjoying what is perhaps the most beautiful of the English lakes. At 7.30 the party left for Glasgow, arriving at 11 p.m.

Edinburgh.

After the entertainment provided for the visiting engineers in Glasgow, described in a previous article, the party left for Edinburgh at 9 a.m. on Wednesday, July 4, and reaching there at 10 a.m. were driven to the Dewar Place and Macdonald Road stations of the Corporation Electricity Department, and by special request of some of the members to the old station of the cable tramways. A short drive through the most beautiful part of Edinburgh ended at the North British Station Hotel, where by invitation of the Rt. Hon. the Lord Provost and the corporation of the city of Edinburgh, the party were entertained to luncheon.

The usual toasts of "His Majesty the King," "Queen Alexandra" and "Our Guests" having been proposed by the Deputy Lord Provost (in the absence of the Lord Provost), a happy reply was made by Mr. Lieb, who reminded those present that it was the national holiday of the Americans and referred to the bonds which now connect the Young Lochinvar of the States with the mother country of Great Britain. Both Mr. Lieb and Prof. H. M. Brooks expressed enthusiastically their appreciation of the organization of the tour and referred to incidents in the American visit of 1904, which showed that America had yet to learn from England in these matters. After a short speech from Mr. Mordey, the party broke up, the majority of the guests going to Edinburgh Castle and the various historical places in the neighborhood.

A few members visited the works of Bruce Peebles & Co., where a large amount of direct-current machinery was to be seen in process of manufacture, and several of the new La Cour-Bragstadt converters were in process of construction. Several large orders have recently been received for these, the chief being that for the Manchester Corporation, mentioned previously. It is of interest to note that these machines are now being made with only two bearings, the rotary of the induction motor and the rotary converter, both being mounted on the same shaft. The same evening the party left for Newcastle-on-Tyne.

Newcastle-on-Tyne.

On July 5 a large party visited the works of Messrs. C. A. Parsons & Co., at Newcastle-on-Tyne, where they spent a very pleasant morning. All parts of the factory were thrown open and the staff were indefatigable in answering questions and showing all the processes in the manufacture of this interesting turbine.

The reputation enjoyed by this firm is such that its products are frequently described in the technical papers, and complete details of the plant would, therefore, fatigue rather than interest. Attention should be called, however, to the following points illustrative of their latest design. Perhaps the most important of the recent improvements in the Parsons turbine is the adoption of the "unstripable blading." In this type a blade very similar to the old form is used, the blades being placed around the drum in a recessed groove, each one separated from its neighbor by a distance piece; and a metal supporting ring is recessed and brazed into the side of each blade at a distance of approximately ¼ in. from the top. The top, ⅛ in., is, however, cut as thin as paper. This is strong enough for the small pressure to be carried by each blade and in case rubbing occurs between the top of the blade and the surrounding cylinder, the former will not break, but simply "burr over." This type of blade is rapidly superseding the old solid type and is also being adopted by Messrs. Brown, Boveri, of Switzerland.

Another feature of interest is the great care taken in supporting the end connections of the alternator armature windings, special brass castings being made which are clamped to the alternator frame and to which the end connections are securely attached.

It is noteworthy that Messrs. Parsons still employ a closed slot construction for the stators of their alternators and consider the extra labor involved by the consequent hand winding of the armature more than counterbalanced by the resulting possibility of making a solid (unlaminated) metal rotor and the much improved wave form. Perhaps the increased self-induction is not a disadvantage, since it tends to limit the short-circuit current and thus to reduce the severe mechanical strains to which a short-circuited turbo-generator is subject.

The method of supporting the punchings is also of interest, no dovetail being used, but simply two steel keys on opposite sides of a diameter. Definite ventilation as now employed throughout by Brown, Boveri in their designs of turbo-generators is not yet the regular practice of the Parsons Company, but is beginning to be asked for somewhat frequently. Readers will recall that this method consists in entirely enclosing the generator in a cast-iron frame and making definite openings for the inlet and outlet of the cooling air. The inlet is generally at the bottom and the outlet at the top in order to take advantage of convection, the main circulating force, however, being obtained by fans attached generally to the rotor. This also renders very easy piping the generator cool air from outside the hot engine room.

In direct-current design Messrs. Parsons employ the compensated winding now so largely used in Europe, especially by the most successful direct-current turbo-generator builders in the world, Messrs. Brown, Boveri, the same principle underlying the new Finzi single-phase motor. This winding is displaced 90° from the main field winding and is in series with the armature, being arranged to produce sufficient flux to just overbalance the armature reaction flux. The gravity pressure brush holders so long employed by this company are still adhered to, other types only being supplied when specially requested.

In addition to the visit to Messrs. Parsons works just described several members of the party afterward went to Messrs. Swan & Hunter's shipbuilding yard and saw the new Cunard liner, the *Mauritania*, in course of construction, which, it will be recalled, is a sister ship of the *Lusitania*, being built at Glasgow. Both these vessels are to have an average speed of 25 knots per hour. After lunch at the Wallsend Drill Hall, the party visited the Carville power station, and later embarked on a steamboat at Carville for Tynemouth, where light refreshments were served at the Bath Hotel, the party returning during the evening. Visits were also made by some of the members to Messrs. Ernest Scott & Mountain's factory, to the Pandon Dene sub-station and the Corporation Tramway power station.

Leeds.

The following morning (Friday, July 6) the party left for Leeds, where, at 1 p.m., a reception was held by the Lord Mayor and Electricity and Tramways Committees in the art galleries, after which luncheon was served in the city hall. Vehicles were then in readiness to convey the visitors to the Corporation Electricity Works, tramway power station and car sheds

and to the works of Messrs. Greenwood & Batley, and of Messrs. Kitson & Co.

At the works of Messrs. Greenwood & Batley, who are agents for the De Laval steam turbines, much of great interest was to be seen, and a large part of the afternoon was spent there. The most interesting features of this turbine are well known and great interest was taken in the cutting of the gear wheels, which give the standard ratio of 10 to 1 between the speeds of the steam turbine and of two direct-current generators which form one steam dynamo unit as built by this company. In each turbine set two of these gear wheels are used and in large sizes—in the neighborhood of 300 kw—each gear wheel takes two weeks to cut.

The latest practice in the manufacture of blades for the steam turbine built by this company is as follows: The steel wheel is first built up in the usual way and the rim is slotted and recessed; each blade is then placed in separately, after which the surfaces are finished off, and it is difficult to detect with the naked eye that the blades are not all cut from one piece. It is of interest to note that this company has lately received an order for two 1,000-kw De Laval turbo-generator sets, which will be the largest ever yet built. In this machine the standard method of geared shafting and the staggered arrangement of the dynamos will be discarded and the turbine wheel and generator will be mounted on the same shaft. It will operate at a speed of 1,500 revolutions. The beautiful mechanical work done by the machinists of this company was a cause of much surprise and pleasure was frequently expressed.

On July 7, while the ladies, accompanied by the larger share of the men, traveled to Harrogate and Fountain's Abbey, a few of the visitors preferring technology to scenery, visited the Leeds Copper Works, which are situated at Thwaite Gate, just outside Leeds. The principal products of these works are brass and copper tubes. The copper, which is received in the form of Chili bars or Japanese slabs, contains about 98.5 per cent pure copper. This is melted down and moulded into long bars suitable for the depositing tanks and at the same time the metal is refined by the admixture of lime and nitre and the oxides removed by stirring with a green wooden pole. The slag from the first furnace contains about 40 per cent pure copper and is further refined so that the slag from the third melting contains only about .4 per cent pure copper.

This slag is taken to the "residue house" where the silver and gold are extracted and sold to the refiners. One ton of residue usually yields an average of 90 ounces of gold and 3,000 ounces of silver, this forming, therefore, a valuable by-product. The cast copper bars are then placed in the depositing tanks, which contain dilute sulphuric acid and copper sulphate. The cathode consists of a revolving core or mandrel of brass coated with black lead and to insure a smooth deposit an insulated metal brush moves slowly up and down the entire length of the bar being driven by worm gear from the main shafting, which also revolves the mandrel.

The pipes made are about 14 ft. long, and vary in diameter from 2 in. to 14 in. and a tank holding 11 2-in. pipes will take 1,500 amp. Any excess of copper sulphate in the baths is taken out by boiling the bath liquid in special vats and crystallizing out. The generators for electrolytic work are four in number and were supplied by the Brown, Boveri Co. They are rated 110 volts, 1,500 amp. and each supply about 70 tanks in series. The power station also contains three 400-kw generators for power and lighting.

The manufacture of brass tubes also is an important branch of this company's work and forms a simple means of disposing of scrap copper. The brass which contains about 70 per cent copper and 30 per cent zinc is melted in small crucibles holding about 300 lb. and then poured into iron tube moulds containing a moulded core baked hard and black-leaded. The tube produced is cleaned off roughly and then drawn out to the required thickness and length.

The text usually called for is 70 per cent elongation on a two-inch length and a tensile stress of 19 tons per square inch.

Return to London.

On Saturday, July 7, the whole party visited Harrogate and Fountain's Abbey, returning to London in the evening, dinner being served on the train. After dinner the train quickly became a scene of leave-taking, as following the example of President and Mrs. Gavey various members of the party passed through the train bidding their friends good-bye.

Shortly before arrival at King's Cross, two handsome photographs were presented to each member of the party by the London & North Western Railway Company, the first showing the special train which had accompanied them on their tour, consisting of eleven first-class dining cars, two baggage cars and two engines; the second showing the party on their arrival at Windermere station, on Sunday, July 1.

The Dinner of the Dynamicables.

On Tuesday evening, July 10, a dinner was given by the Dynamicables Dining Club in honor of "Our Dynamic Friends from Over Seas." A large number of the foreign visitors had remained in London and a most enjoyable evening was spent. Col. H. Capel L. Holden, R.A., F.R.S., was chairman and was supported by Col. Crompton.

The opportunity was taken at this dinner by the members of the American party of presenting small souvenirs to the staff of the English Institute to whose labors the success of the recent tour through England was due. The following presentations were made: To Mr. Lloyd, secretary of the English Institution, a silver punch bowl, by Dr. Wheeler, president of the American Institute. To Mr. Rowell and Mr. Tree, assistant secretaries, cigarette boxes were presented by Mr. Mailloux and Mr. Pope; and to Mr. Longridge, who had had entire charge of the transport and arrangement of baggage, a silver card case was presented by Mr. Lieb. These presents were made personally from the members of the American party, and not in any way representing the Institution as a whole.

In presenting these souvenirs emphasis was laid upon the wonderful organization of the tour from start to finish, and some humorous comparisons were made between the recent English tour and the American tour of 1904. Mr. Lieb recalled the problem which faced him at New York after the return of the visiting engineers from St. Louis, when he found himself confronted by over 600 pieces of baggage of various conditions and nationalities and with no owners to claim their possessions.

The toast to the guests was replied to by the Vicomte de France, representing France; Dr. Wheeler, representing the American Institute; Herr Naglio, representing the German party, and Signor Simenza, the honorary secretary of the Italian Institute. Col. Crompton also proposed a toast to Mr. Gray, chairman of the reception committee, and expressed regrets on behalf of Prof. Perry, Mr. Hammond and several other prominent members who were unable to be present.

The thanks in response to the cheers called for by the chairman for the foreign guests were led by Mr. C. O. Mailloux, of New York. A vocal and musical programme was rendered during the evening in which a violin solo by Mr. T. E. Gatehouse of the London *Electrical Review* was heartily encored.

French Regulation for the Distribution of Electrical Energy.

We are indebted to Consul-General Robert P. Skinner, of Marseilles, France, for the following account of recent governmental action in France affecting the electrical industry:

The distribution of electrical energy throughout southern France is proceeding with rapidity, and the works now built or building have compelled Parliament to consider the best methods of controlling a new situation. Americans will be struck first of all, perhaps, by the refusal of the large French cities to permit the erection of unsightly poles and overhead wires. Two companies are preparing to deliver electricity throughout the city of Marseilles at this moment, and neither has been permitted to raise a single pole. On the other hand, great progress has been made in the manufacture of underground cables, which are carefully insulated and rendered impermeable, so that they may be laid in ordinary trenches exactly like gas pipes. As a rule, when the trench is prepared, a layer of crushed limestone is spread on the

bottom, and after the cable is put in place it is covered by thin bricks for protection against digging tools. The methods adopted are comparatively cheap and are said to involve no danger to life or property or commercial disadvantages. As the location of breaks can be determined before a pick is placed in the earth, just as flaws in ocean cables can be located, the construction of expensive permanent underground conduits may be dispensed with.

The action of Parliament above referred to is expressed in a law promulgated June 15, 1906. No pretence is made of fixing any hard and fast rules which might hold electrical development in check, but a few general principles are set forth and the practical questions arising from each specific demand for the right to transmit energy is turned over to a committee, thus constituted:

"Art. 20.—A Committee of Electricity shall be formed, composed, as to one-half of its membership, of professional French representatives of the important electrical industries, and for the other half of members taken from the administrations of the Interior, Public Works, Commerce, Industries, Posts and Telegraphs, War and Agriculture.

"The functionaries who are members of this committee, to the number of fifteen, will be named by decree upon the proposition of the Ministers of the Interior, Public Works, Commerce, Industry, Posts and Telegraphs, War and Agriculture, each minister named to nominate three persons.

"The professional representatives of the great electrical industries, to the number of fifteen, will be named by decree upon the proposition of the Minister of Public Works and the Ministers of Commerce, Industry and Posts and Telegraphs.

"This committee shall give its advice in all the cases foreseen by the present law, upon every point presented to it by the interested ministers, and its mode of operation shall be determined by a public administrative regulation."

Some of the articles of general application in the new law are worthy of reproduction, and I supply a translation herewith:

"Art. 2.—A distribution of electrical energy which at no point traverses the public highway, may be established and exploited either without authorization or declaration, or when the conducting agencies are to be established at a point at least ten meters (32.8 ft.) from an existing telegraph or telephone line, by virtue of an authorization delivered under conditions specified in Title 2 of the present law."

Title 2, above referred to, requires that electrical installations must be exploited and created in a manner such as will not induce, by induction, leakage or otherwise any trouble in telegraphic and telephonic transmissions over existing lines. The same title requires that if telegraphic and telephonic communication is found to be interfered with, the line transmitting electrical energy shall be moved or modified at the expense of the exploiting company.

Provision is made for the organization of important public works, which may be declared to possess public utility by the Council of State, and being so declared, the holders of the concession possess the right to expropriate and all the other rights which the laws and regulations confer upon the State administration in respect to public works. The declaration of public utility as applied to the distribution of energy, confers, moreover, to the concessionaire these special privileges:

(1) To establish permanently supports and anchorages for aerial conductors of electricity, either upon the exterior of walls or facades upon the public highway, or upon the roofs and terraces of buildings, on the condition that access thereto may be had from the outside, and providing also that the electrical current transmitted by lines in proximity to existing buildings shall not present grave danger, either for the occupants of such buildings or the buildings themselves.

(2) To pass electrical conductors above private property under the same conditions as those enumerated in par. 1.

(3) To establish permanent subterranean canals or supports for aerial conductors, upon private ground not occupied by buildings, and which is not closed by walls or other permanent enclosures.

(4) To cut the branches of trees which might by their movement or fall create short-circuits or damage to the electrical transmission plant. Execution of all works should be preceded by a direct notification to the interested persons, and cannot take place until the project in detail has been approved by the Prefect.

These rights do not involve the right to dispossess. The fixation of supports upon walls or facades or upon roofs or terraces of buildings may not obstruct the right of a proprietor to demolish, repair or raise. Similarly, the construction of conduits or supports on open and unbuilt ground may not prevent the proprietor from closing up the ground with walls or from building thereon. The proprietor is obliged, one month before undertaking to demolish, repair or raise, close or otherwise build upon his property, to inform the concessionaire, by letter, of his project.

The indemnities which may be due by reason of the servitude of support, passage and removal of branches are regulated in the first resort by the justice of the peace. If expert opinion is required, the judge may name but one expert.

It is clearly set forth in the law that by administrative regulation the security of the public will be provided for, and that companies securing concessions will be required to compensate the State, the department and the communes for the occupation of the public domain according to an appropriate tariff.

Instructions will be issued by the Minister of Public Works, the Ministers of Commerce, Industry, Posts and Telegraphs, acting under the advice from the Committee of Electricity, in regard to the technical conditions in which distribution of electrical energy may be undertaken, these instructions bearing upon the security of persons, and of the interested public services and the protection of the landscape. These conditions will be subjected to annual revision, whereby the government will be enabled to keep pace with progress in electrical engineering.

The Oxidation of Atmospheric Nitrogen in Electric Arcs.

With the above table, Prof. K. Birkeland presented a paper at the July meeting of the Faraday Society relating to his process for the fixation of atmospheric nitrogen, recently described in these columns. The paper opened with a brief history of the oxidation of nitrates by means of electricity, including references to the pioneering work of Priestley and Cavendish (about 1780), to the more recent work of Spottiswoode and Dewar (1880), Crookes (1892), and Rayleigh and Ramsay (1897), and finally to the technical applications developed by Bradley and Lovejoy (1903), and by Kowalski and Moscicki (1904).

The essence of the electrical side of the problem consists in the production of a stable and practical form of high-tension arc in which to effect the oxidation. This the author produces by placing an alternating current arc equatorially between the poles of a powerful electromagnet. The arc thus formed moves across the electric field with enormous velocity, while its length, and thus its resistance, increases so that the tension is heightened until a new arc forms at the points of the electrodes, and the long outer arc is extinguished. The positive and negative arcs move in opposite directions, and in this way a complete, luminous, circular disc of flame is formed. When the proper conditions are attained, and the arc is stable, one arc only, as shown by oscillograph records, is formed at each reversal of the current. The potential employed is 5,000 volts, and the frequency 50. The electrodes, which are 8 mm. to 1 cm. apart, are made of copper tubing 15 mm. in diameter, and are water-cooled; 7.5 per cent. of the energy is wasted in this way as heat. The electrodes are rmoved for repair every three hundred hours.

The disc-flame is enclosed in a special furnace, the fire-chamber of which is only 5.15 cms. wide, and air is driven into the central region by a Root's blower. At Notodden there are three such furnaces each employing 500 kilowatts. In the new 30,000-H.P. plant, now in course of erection, the furnaces will each absorb from 750 to 850 kilowatts.

The air (75,000 litres per minute at Notodden), which after passing through the furnaces contains about 1 per cent. of nitric oxide, discharges its superfluous heat into a steam boiler, cooling from 700° C. to 200° C., and, finally, at 50° C. it enters the oxidation chambers in which the nitric oxide becomes nitric peroxide.

It then passes to the absorption towers to be dissolved in water, forming, finally, 50 per cent. nitric acid. The unabsorbed nitric fumes are converted in a fifth, milk-of-lime, tower to calcium nitrite and nitrate, which in turn is completely oxidized to nitrate by means of nitric acid. This nitrate lye, mixed with the bulk of nitric acid, reacts on limestone, and is converted into a solution of neutral calcium nitrate which may be crystalized out either in the normal or the basic form. The yield of the furnaces is given as 500 kilogrammes of anhydrous nitric acid per kilowatt-year, but this is a minimum yield. The inclusive cost of production is stated to be £4 a ton, the selling price being £8 a ton; at Notodden about 25s. per E.H.P.-year is paid for power, but the cost is less than half of that.

The author finally discussed the theory of the oxidation of nitrogen in electric arcs, and incidentally described experiments made to determine the thickness of the arc threads. According to the simple thermo-chemical theory, at every temperature a definite amount of NO is in equilibrium with a fixed mixture of air and nitrogen; at 3,000° C., for example, an entire 5 per cent. will be nitric oxide. To retain this quantity at a lower temperature the cooling must take place with very great rapidity. The great difficulty in making theoretical calculations is that of knowing the temperature of the arc. The author compared results obtained during a very careful trial run at Arendal with those calculated from Nernst's formula, assuming various temperatures for the arc, and he finally, after allowing the length of time the maximum temperature is effective, assumed an average temperature of 3,200° C. A higher temperature should be arrived at in practice, for the maximum theoretical output coincides with about 5,200° C. To estimate the number of molecules in the arc that are split up into ions, comparisons were suggested with air ionized by means of radium. It may be that the proportion of gas ionized will be of determinative importance to the chemical equilibrium of gas compounds.

In reply to inquiries, Prof. Birkeland stated that less than 0.7 per cent. of the total energy was absorbed in the magnets, and that in the new works only about 3 per cent. of the total power would be used for auxiliary purposes outside the furnaces. Greater efficiencies than 179 gms. per kilowatt-hour had been obtained recently. The power at Notodden for which 25s. per E.H.P.-year was paid cost only 11s. The flow of gas cannot exceed a certain amount, or the flame would be extinguished.

The chairman alluded to the well-known important work of Prof. Birkeland on the aurora borealis and on the action of magnetic fields on cathode discharges, and showed how those purely scientific investigations led up to the working out of the present industrial process.

Unification of Central Station Service in St. Louis.

The Union Electric Light & Power Company, of St. Louis, has been successfully accomplishing the important work of unifying its various classes of service. As described in these columns October 17, 1903, this company found itself, as a result of consolidations, with a large number of different kinds of distributing systems and power stations. Among the unusual classes of service found were an extensive system of single-phase light and power distribution and a direct-current distribution at 235-470 volts, three-wire. The plan of unifications, which is now nearly completed, is to supply direct current to a 115-230-volt, three-wire network in the down-town district and to supply three-phase alternating currents elsewhere in the city. Practically all the power is being supplied by the large new power station at Ashley Street on the Mississippi River. Single-phase motors in the down-town district were exchanged by the company for new direct-current motors. Since second-hand single-phase motors command as high a market price as new direct-current motors, the company lost nothing by this change. In cases where customers had 500-volt or 470-volt direct-current motors, they were rewound at the company's expense. The change from one kind of service to another was made without inconveniencing customers. This made it necessary to do most of the changing nights and Sundays. The company converted its old Imperial plant into a rotary converter sub-station. This Imperial plant formerly gave 470-volt, three-wire, direct-current service. In order to continue this service during some of the changing, two 250-volt rotary converters were run in series. Customers on this service were finally changed to the 115-230-volt circuits. Taken all together, the change was accomplished with a remarkably small amount of trouble and friction and the company is now, of course, on a much more satisfactory operating basis than ever before.

Municipal Plant for Johannesburg, South Africa.

The Johannesburg, S. A., municipal plant, which is now nearing completion, will supply electrical energy throughout the whole municipal area, which covers nearly 100 square miles, and includes a portion of the gold reef. The consulting engineers are Messrs. Mordey & Dawbarn, of Victoria Street, London.

The generating station is situated nearly in the middle of the area and the municipal power for driving the dynamos is obtained from gas engines operated with producer gas. The first part of the plant, which is now being put down, consists of five engines of 2,000 hp, and three engines of 1,000 hp. Direct-current machines will supply either the 460-volt, three-wire system for the center of the town or work at 500 to 550 volts for tramways.

The outer area of the municipality, which is almost entirely residential, will be served by two-phase, 50-cycle, 3,000-volt alternators, supplying transformers distributed throughout the district. The actual lighting is being arranged for single-phase supply for ordinary purposes and two-phase for special purposes, the secondary pressure being 200 volts. The tramways will consist of nearly 60 miles of line, a considerable portion of which is already laid, and some sections are at work.

CURRENT NEWS AND NOTES.

CABLE AND WIRELESS TELEGRAPH CONCESSIONS.—A concession has recently been granted by the Government of Colombia to Francis J. Fernandez, of that country, for a coast cable, and also for the exclusive privilege of erecting wireless telegraph stations within the jurisdiction of Colombia. It is the intention of the concessionaire either to sell his privileges or develop them with foreign capital. His representative in New York is Mr. Agustin Fernandez, care of A. N. Capen's Sons, 60 Pearl Street, New York City.

CABLE CUTTING IN NEW ORLEANS.—A couple of men have been arrested in New Orleans for stealing heavy sections of underground cable belonging to the Consumers' Electric Company, whose system was virtually put out of business by the theft. Moreover, the cables were hacked and left open-ended so that whole sections are likely to have their insulation ruined by mud and water. There was little trouble in following up such a foolish theft as this, as the stolen goods are difficult to dispose of. The men implicated had been at work pulling in the cables.

WIRELESS ON THE PACIFIC.—According to official advices from Washington the United States Navy Department will soon have the Pacific Coast equipped with wireless stations as the Atlantic Coast is now equipped, so that messages may be received at some stations either day or night. Wireless stations have been completed and equipped at San Diego, Arquello, Farralona and Mare Island. Farralona is just outside of San Francisco Harbor, and the station was located there in order to have the communication over sea as much as possible from one station to the other. Stations are now being constructed at Table Bluff, Cape Blanco, North Head and Cape Flattery. The stations are from 130 to 210 miles apart, and when they are all erected and the apparatus installed it will be possible to communicate the whole length of the Pacific Coast either in the day or the night.

OUR COPPER INDUSTRY has reached such a magnitude that the exports of $86,225,291 in 1905 were six times what they were in 1895. In the eleven years, 1895 to 1905, inclusive, there was exported from the United States copper valued at nearly half a billion dollars. In this period copper shipments were exactly $459,347,254. The outward movement of this metal grew from $14,468,703 in the former year to $86,225,291, an increase of $71,756,588, or approximately 500 per cent.

LONG INDIANA TROLLEY.—Announcement is made that surveys and estimates have been completed in Illinois and Indiana for an electric railway 70 miles in length, to be known as the Chicago, Lake Shore & South Bend Railway. It is reported that the road will be financed by the Transit Finance Company, of New York. The terminals of the road will be South Bend and Hammond, and it is planned that the line shall be continued from Hammond into Kensington by the Illinois Central Railroad, there connecting with its main line for through service into Chicago. A steamer service on Lake Michigan is planned in conjunction with the new road.

HUGE TELEPHONE REFUND.—It is stated from Chicago that refunds of $50 each to telephone subscribers who pay the maximum rate, with the exception of those who prefer to keep up litigation, will be given by the Chicago Telephone Company. The amount of refunds probably will reach $400,000, and those who have been paying $175 a year for the maximum service, with or without contracts, will be able to get the rebate as far back as January, 1902, when Judge Tuley gave a decision that only $125 could be charged under the terms of the ordinance of 1889. The news of this concession is based on a letter written by President Wheeler to the general counsel for the company, John Barton Payne, in response to a letter from Mayor Dunne, asking that maximum subscribers, even without contracts, be allowed rebates, and that the ordinance of 1889 be obeyed.

ELECTRICITY ON GREAT NORTHERN.—Mr. J. J. Hill is debating the possibility of using electricity on the new section of the Great Northern Railroad, and has already consulted with one or two prominent electrical engineers on the subject. He says that the new line under construction between Pasco, Wash., and Portland, Ore., will be the most expensive bit of "first construction" in the history of American railroading. He adds that the road will be built through to Spokane if feasible grades can be obtained, and that a part of it may be operated by electricity. His engineers are also at work on plans to electrify the Cascade Tunnel. The road is practically the first Pacific coast extension built to secure a water level grade line. It is built to compete with the Oregon Railroad & Navigation division of the Union Pacific system, which follows the south shore of the Columbia River.

WIRELESS IN DAYLIGHT.—It was soon discovered that the wireless telegraph loves the darkness rather than light. An interesting dispatch from Washington of July 21 deals with this point as follows: "It has long been known that wireless telegraphy is easier at night than in the day, but that fact was lost sight of in the establishment of that method of communication in Alaska, between Fort Michaels and Nome, where it had been found impossible to maintain a cable owing to the ice movements and currents. Reports to the War Department now show that for the first time trouble has been experienced in working the system in Alaska, and as the trouble was coincident with the beginning of continuous day north of the Arctic Circle that fact is supposed to account for the difficulty. However, it is said that the interruption has never extended over the whole day at any time." Wireless communication is now being used from the Wellman balloon camp at Dane's Island, Spitzbergen, to Hammerfest, Norway. The camp is within 600 miles of the North Pole, and reports all preparations favorably.

IMMENSE FOREIGN COMMERCE.—The figures of the Bureau of Statistics of the Department of Commerce and Labor show that the foreign commerce of the United States in the fiscal year just ended aggregated $2,970,000,000, thus falling but $30,000,000 below the three billion dollar line. If the trade with Porto Rico and Hawaii, which was included in this foreign commerce prior to their annexation, were added, the total would materially exceed $3,000,000,000. Both imports and exports exceed those of any earlier year. The total imports of the year were $1,226,000,000, exceeding the highest record of any earlier year (1905) by $109,000,000, and the exports were $1,744,000,000, exceeding those of the highest record year (1905) by $225,000,000. The excess of exports over imports was $517,000,000, exceeding that of 1905 by $116,000,000, but falling below that of each year of the period 1898-1901. Comparing 1906 with the figures of five years earlier (1901) imports show an increase of $403,000,000, and the exports an increase of $256,000,000. Comparing the figures with those of ten years earlier (1896) the imports show an increase of $447,000,000 and the exports an increase of $861,000,000. Of the exports not less than about $600,000,000 were manufactures.

BEIT BEQUESTS.—Mr. Alfred Beit, the great South African financier, who died last week in London, has left nearly $10,000,000 for public purposes. One hundred and twenty-five thousand dollars is given to the research fund of London University, $125,000 to the Rhodes University, Grahamstown, Cape Colony; $100,000 to Mr. Beit's firm in South Africa, for educational or charitable purposes in the Transvaal; $75,000 for the same purposes to Kimberley and Cape Colony. Two hundred thousand dollars is to be distributed equally in London and Hamburg by Mr. Beit's executors for educational or charitable purposes. The testator also says in his will that, believing that civilization can best be advanced in Africa by the construction of railways, telegraphs, telephones and wireless telegraphs, and knowing how difficult it is to raise money for these purposes, he leaves $6,000,000 in stocks and shares to his partners to constitute a fund, the income of which is to be devoted to the construction, equipment or furtherance of any such methods of communication or transportation in Rhodesia, Portuguese Southeast Africa or the German possessions, and any parts of Africa that may be traversed by the Cape-to-Cairo Railway. The trustees are to have absolute discretion, and if two-thirds decide that the fund is no longer required for furthering the work of communication or transportation they can apply the proceeds to educational, charitable or other public purposes in Rhodesia.

ICING A HOLE.—The plant for cooling the New York Subway at the Brooklyn Bridge station will soon be in operation. The plan, as already noted in these columns, is to distribute through ducts air cooled by water pumped from driven wells and run through coils in front of which will be swiftly-revolving fans motor driven. The cooled air will be forced by the fans through the ducts, which will run along the ceiling of the station above the platform. It is hoped to lower the temperature from 8 to 10°. Four wells have been driven at the north end of each island platform. Their combined capacity will be 400 gallons of water per minute, and the temperature will range from 52 to 62°. The coils which will receive the water will have a surface sufficient to cool 75,000 cu. ft. of air per minute, and it is estimated they will lower the temperature 15°. The fans, which will reinforce the refrigerating capacity of the coils, are to be constructed of iron and will have a diameter of 9 ft. There will be four of the electric ventilating fans with a combined distributing capacity of 150,000 cu. ft. of air each minute. The plant is divided into two distinct units, one located on the east side of the station and designed to cool that side and the other on the west side to perform the same function for the west platform. At regular intervals there are drops—openings three feet square—in the bottom of the ducts, through which the cooled air issues. In this process the pressure exercised by the fans on the current of air is assisted by the greater weight of the cooled air. It is believed by the designers of the plant that it will solve the problem as far as the stations are concerned at least, and that as soon as it is in operation the passengers will no longer have to breathe the overheated foul gases now honored with the name of air in the subway.

FLAMING ARC FOR LONDON.—Advices from London state that one of the leading thoroughfares in London, namely, Oxford Street, from the Marble Arch to Tottenham Court Road, is to be lighted by means of 81 flaming arcs. This will make it one of the best illuminated streets in the world.

THE CARNEGIE INSTITUTE, Pittsburg, is to be opened in April, 1907, and a number of distinguished men have been invited from Europe to participate in the exercises as guests of the Institute. These include Prof. Röntgen and Sir W. H. Preece. It would be a good idea if the formal dedication of the United Engineering Building in New York City could be timed for about the same date.

PRICE OF ILLUMINATING GAS IN ENGLAND.—Consul F. W. Mahin reports that the price of illuminating gas in Widnes, Lancashire, England, is now 32 cents to small consumers, but will be reduced to 30 cents on July 1. Large consumers will pay from 22 to 26 cents. This is claimed to be the cheapest gas in the world. The town has about 30,000 population. The price of gas is remarkably low everywhere in Great Britain, whether under public or private control, the general range of price being 40 and 70 cents.

SECURING A GREAT POWER.—It is rumored persistently in Baltimore financial circles that the Pennsylvania Railroad has obtained control of the McCall's Ferry Power Company, engaged in developing electrically the falls of the Susquehanna River at McCall's Ferry and Conowingo. The Pennsylvania Railroad, it is said, is not known in the matter, and for obvious reasons desires that its interest be kept under cover until legal difficulties that may stand in the way of the utilization of the power are removed. The plan, it is said, is to utilize the energy for the operation of electric trains.

LONG ILLINOIS TROLLEY.—It is stated that the Illinois Traction system, known as the McKinley route, will be the nucleus of an electric line between Chicago and St. Louis, with branches radiating to Peoria, Streator, Jacksonville, Ottawa, Galesburg and other points. Work is in progress on a line from Springfield to Bloomington, 60 miles, and an extension from Bloomington to Joliet is under way. When completed, with the lines north of Joliet and south of Springfield, there will be 290 miles of continuous trolley. Early next year there will be a direct line from St. Louis to Danville, Ill., via Springfield and Decatur. It is proposed to operate limited passenger trains and carry light freight.

CHICAGO SUBWAY MAILS.—Connection between the post office and La Salle Street depot through the Chicago Subway's tunnel has been established for mail service. The Chicago postmaster announces that mail service through the bore to the other depots will be in operation by September 1. President Wheeler, of the Illinois Tunnel Company, says the subway will be in full operation by the first of next year. There are six main railroad connections. Under the post office is a system of great electric chutes by which mail is transferred to and from the tunnel mail cars. The new mail service will be by far the fastest in the world. It does away with the big mail wagons and to that extent relieves the traffic of the streets. The gross earnings of the Chicago Subway will be increased $172,600 annually by the mail contract.

TELEPHONY ON RAILROADS.—Statements were made last week by officials of the Maryland division of the Pennsylvania Railroad that the telephones recently installed in the railroad towers at Aberdeen, Magnolia, Charlestown, Bush River and Bengies, Md., in order to reduce the force of telegraph operators, will be removed. The telegraph equipment will be re-established and the operators reinstated. The telephones, which were found to be unsatisfactory, were substituted on June 1 as a result of the eight-hour law for operators in Maryland going into effect on that date. The wages of operators on the Pennsylvania Railroad in Maryland were also reduced with the less number of hours, those receiving $60 a month being cut to $49, while those paid $55 were lowered to $44. The protest of this reduction has not been adjusted, although several conferences have been held between a committee of the Order of Railway Telegraphers and General Manager Atterbury in Philadelphia.

REFUSING WIRELESS MESSAGES.—The Marconi Wireless Telegraph Company has denied officially that its operator on board the Red Star liner *Vaderland* had refused to give the location of a derelict when asked by wireless by Capt. George McDonald, of the United States naval collier *Lebanon,* which uses another system of wireless. Capt. McDonald, who has filed a complaint in Washington against the captain of the *Vaderland,* said that while searching for a derelict he asked the *Vaderland* the position of the wreck, and that he received a reply in which the *Vaderland* operator said that he was forbidden by his company to give him the desired information. Mr. John Bottomley, secretary of the Marconi company said when interviewed on the subject: "There is no record of any such message having been received on the *Vaderland,* and I cannot account for the statement being made. We do not communicate commercially with other companies, it is true, but it is different when a ship is in trouble, and in such cases as this one appears to have been. Our orders are always to receive such messages, even though they come from the devil himself."

MAIN LINE ELECTRIC LOCOMOTIVES.—Last October the first half of the 50,000-mile endurance run of the first high speed electric locomotive, built jointly by the General Electric Company and American Locomotive Company, was completed on the test tracks of the New York Central lines in Schenectady. On June 12 this locomotive completed the second half of this exhaustive service test. The maintenance expense per mile for the complete 50,000-mile run amounted to $0.0126. This figure includes all maintenance expense on motors, brake shoes, tires, inspection, and other miscellaneous items. Moreover, the operating conditions were much more severe than those to which the thirty-five electric locomotives, which have been ordered, will be subjected. The test locomotive hauled a train averaging 200 to 400 tons over a six-mile track, and high speed running under these conditions involved higher braking and accelerating duty than in regular operating service. Eight of the thirty-five 100-ton, 2,200-hp electric locomotives which the manufacturers have built for the New York Central Lines, follow the same design as the locomotive No. 6000 which has made such a satisfactory record. There are in all fourteen machines now complete. Of the eight locomotives noted, two have been shipped to New York. The remaining locomotives are well under way at the shops of the General Electric Company and the American Locomotive Works and it is expected that the complete number, thirty-five, will be ready for service early in October.

TELEPHONE GARDENS.—The roof garden for the Bell telephone girls in Boston is eclipsed by the real gardens maintained under official encouragement and auspices at six of the exchanges of the system in Chicago. Each garden annually is prepared and watered by the station janitor, who also mows the little lawn and performs all the heavier horticultural duties. Bushes, vines, seeds, plotting plants, and tools are supplied on demand, the girls twice a year sending in a list of the supplies needed. These preliminaries arranged, the same girls joyously attend to the daintier gardening operations, finding such tasks so pleasant that the parlors, rest rooms, and book cases, so popular during the winter months, are neglected so soon as spring whispers of coming. Each exchange operator is entitled to a fifteen minutes' rest period after every two hours of service, with from half an hour to an hour for luncheon. These rest periods, together with much of the luncheon time, almost invariably are devoted to the gardens. The remarkable amount of successful gardening work that may be accomplished in these brief sessions is attested by the smiling gardens. The fact that in most of the stations the tending nominally is in charge of a regularly elected or appointed flower committee does not deter each and every girl from taking hold, and under a new plan of allotment to every pair of operators is assigned one of the small beds into which the trim little border garden is divided, with the privilege of individual choice of the kind of seeds to be planted.

PREPAYMENT METERS.—The latest figures from England show that gas prepayment meters have increased in one year in London proper from 396,000 to 454,200, in the suburbs from 107,313 to 130,017. Nine municipal plants increased their prepayment meters from 162,844 to 180,124; eight provincial private plants have increased from 79,000 to 95,615 prepayment meters; they are increasing more rapidly than ordinary meters.

TROLLEY ACCIDENTS.—The Brooklyn Rapid Transit Co. has filed with the state railroad commissioners a report upon the deaths caused by its cars during the year ended June 30, 1906. The total number killed was 111, of whom only 13 were passengers. In 76 cases there was no liability upon the company. To show the volume of traffic, the company states that during the year it carried 452,604,203 passengers. For every passenger killed the company has carried the entire population of Brooklyn three times.

CHANGE TO ELECTRICITY.—Discussing the general industrial situation the Boston *Commercial* says: "As soon as business activities begin to decline and labor payrolls are reduced the supply of idle money will grow large enough to absorb the unsold bond issues now in the hands of underwriters, and this will make room for the financing of new enterprises and improvements. There are increasing evidences that a great and general transition from steam to electric power is at hand. We know of an instance, for example, where a great concentrating mill in the West has been offered a supply of electricity at exactly one-half the cost of its steam power. The industrial importance of such economy as this can hardly be appreciated. If a saving of as much as 25 per cent can be secured by the general adoption of electricity, the changes in power plants will supply employment to an army of men for many years to come."

ANOTHER DRAWBAUGH INVENTION.—Mr. Daniel Drawbaugh, who many years ago contested Prof. Alexander Graham Bell's telephone patents unsuccessfully, and who has been turning out inventions at Eberlys Mills in rapid succession for the past 25 years, has announced that with the aid of Dr. B. E. Gamble he has devised a practical fuel to take the place of coal. This fuel is being manufactured at Bowmansdale, east of Carlisle, Pa., by a secret process. It is composed of chemicals and a fibrous matter and weighs only half as much as coal. The new fuel will be made in different size molds. It is asserted that tests made with the fuel showed that it does not clinker, burns to a fine ash, emits little gas, burns freely, gives off more heat than coal, and lasts longer. It will probably cost about half as much as coal. Mr. Drawbaugh's claims to the invention of the telephone got as far as the U. S. Supreme Court, but were long since forgotten except by "old-timers."

ENGLAND AND CANADA.—Some very interesting considerations as to colonial engineering work and machinery export are discussed in the special Empire Number of the London *Engineering Review.* As to Canada, it is remarked that so far as mechanical and electrical engineering are concerned, comparatively little has been done by British firms to secure their due share of the business arising from the great activity that has been displayed of late in the equipment of industrial works and the execution of contracts for municipalities all over the country. The *Review* points out that, quick to seize upon every opportunity for trade, engineering firms in the United States have established Canadian works for the production and supply of their specialties without the payment of import duties, and for the purpose of counterbalancing the 33½ per cent preference accorded to manufacturers in the home country.

TELEGRAPHY A CRIME.—American residents of the Isle of Pines are excited over the imprisonment in the common jail at Nueva Gerona of Miss Millie Brown, 19 years of age; L. G. Giltner, postmaster of the town of Columbia, and William Augustine, all Americans. The three, for their own instruction and amusement, had constructed a toy telegraph line, 1,800 ft. long, strung from Giltner's store to the residences of the other two. They were arrested without warning, charged with the violation of an old military order prohibiting other than government telegraph lines, tried by a newly appointed judge and sentenced jointly to pay a $500 fine or to a joint term of imprisonment of 100 days. All refused to submit to the payment of the fine and were taken to jail in their own conveyance to serve thirty-three days each. The jail has no accommodations for women prisoners. Later advices report the removal of Miss Brown to the mayor's house for safe keeping. Where the government owns the telegraphs this is the kind of thing that may be expected.

DENATURED ALCOHOL.—As a result of the passage of the bill allowng the sale of alcohol without the internal revenue tax, the Department of Agriculture has decided to publish a bulletin January 1, 1907, when the law goes into effect, giving the public a collection of the best obtainable data on the use of alcohol in small engines. For this purpose Prof. C. E. Lucke has been retained by the Department as expert to conduct these investigations in the laboratories of Columbia University, New York City. This bulletin will contain all of the work done on the subject, both here and abroad, a complete bibliography, together with the results of experiments and the conclusions drawn therefrom on American engines. The scope of the work being so extensive, Prof. Lucke is extremely anxious to secure the co-operation of everybody interested by first giving the fullest publicity to the investigations. If any of our readers have patents on the subject he would like to know it, and if they have vaporizers, carbureters or complete engines he invites them to submit these pieces of apparatus to tests in the laboratory. These tests will be conducted without any expense whatever to the public, except the transportation of the apparatus. The reports will be published in the bulletin. Any data or shipments should be addressed to Prof. Charles E. Lucke at Columbia University, and they will be returned when the work is completed, due acknowledgment being given for the assistance rendered.

ELECTRICAL ENERGY FOR LONDON.—It is announced from London that the Select Committee appointed to consider the Electric Supply bill proposed by the London County Council has for the fourth time reported adversely on the proposition. It is not willing to permit the Council to dabble with a far-reaching and pressing problem which needs treatment on definite business lines. The action of the committee will have the effect of delaying action until the time comes for the production of some adequate proposal, as all bids introduced during this session will be postponed. The crucial point in the whole controversy is that the manufacturers and railways and the other users of power in London urgently require electrical energy, but cannot obtain it from existing lighting or traction plants, and must be free from the entanglements of municipal trading. London is to-day pre-eminently the greatest field in the world for the supply of electric power, and yet, according to an expert writing in the *Times,* through unnecessary municipal interference and the apathy and timidity of Parliament, her railways and manufacturers are unable to purchase a commodity of which they stand in urgent need. The evidence submitted to the committee shows that in the Tyneside district, where this problem has been taken up and carried through on sound engineering and commercial principles, nearly all the important factories are already being driven by electricity purchased from a power company. Though the London region is by far the greatest concentration of industrial interests in the world, electricity has been adopted to a smaller extent there than in any other large community. The signatures of manufacturers attached to one petition to Parliament in favor of last year's scheme represented in horse-power of machinery a demand equal to that of a district as important as the Tyneside. New York, with a population but a little over half that of London, has an annual output of nearly 1,000 million units of electricity, while London has only a little over a quarter of this amount, an infinitesimal amount of which is used by factories and workshops. The estimated requirements of London for electric power and traction, apart from heating, lighting and County Council tramways, is 1,800 million units per annum. This represents a plant capacity capable of dealing with a maximum load of 430,000 kw.

Oil Engines in the Sherman, Texas, Central Station.

AN interesting central station in Texas is that of the Sherman Gas & Electric Company, which has been operating entirely by Diesel oil engines since Jan. 1, 1905. The Sherman plant is one of a half dozen central stations controlled by the Dallas Securities Company. On June 1, 1905, this company purchased an old electric light plant which had been operated in connection with a cottonseed oil mill in Sherman. The plant as purchased was almost worthless, and since an entirely new building was necessary it was decided to put in Diesel engines to use Texas crude oil for fuel. This decision was reached as a result of an exhibit of this engine in the power plant of the Tyrolean Alps at the St. Louis Exposition. The move was, nevertheless, regarded as somewhat of an experiment, and the building was erected so that it could be utilized for a steam plant if the performance of the engines did not come up to the guarantees of the manufacturers. Although the old plant was entirely alternating current, it was decided to install direct current for use in the downtown district. The principal factors that influenced this decision were the better illuminating efficiency of direct-current arc lamps for commercial lighting as compared with alternating arc lamps, and the possibility of using direct-connected generators with the Diesel engine. The direct-current arc lamp was considered of much importance in capturing commercial business because of the strong foothold that gas had in the town. The general condition and business management of the old plant can best be judged from the fact that gas gained such a strong hold in spite of the warm climate of Texas. The old plant had 3½ hp in motors connected, not including fans, and only three arc lamps were in use.

Between $600 and $700 worth of fuel per month was being burned in the old plant at the time it was shut down. For the month of January, 1905, which was the first month of operation with the Diesel engines, the fuel bill was $95. The connected motor load is now 225 hp. The increase in gross revenue since the present company took hold is about 300 per cent. The peak load in May, 1906, was 800 amp. at 250 volts. Alternating current is still used in the outlying districts. In the downtown district the competition of gas arc lamps has been met mainly by 3½-amp. arcs with ⅜-in. carbons. Direct-current service runs out about 4,000 ft. from the station.

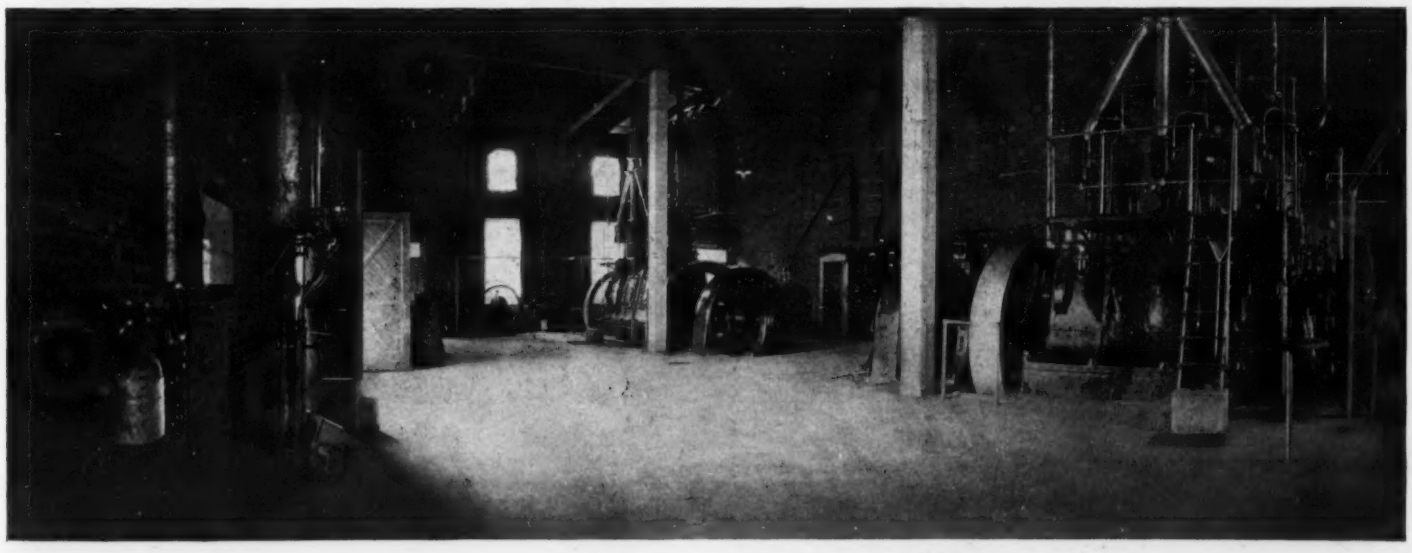


FIG. 1.—GENERAL VIEW OF SHERMAN OIL ENGINE STATION.

THE DIESEL ENGINE PLANT.

Fig. 1 shows a view of the interior of the power plant, which is a substantial brick building. The plant contains two 225-hp, 3-cylinder Diesel oil engines running at 160 r.p.m. Each engine is direct-connected to a 160-kw, 250-volt, direct-current generator. Alternating current is supplied by a 60-kw motor-generator set consisting of a 250-volt motor direct-connected to a 60-cycle, 1,100-volt, single-phase generator. This is to be replaced by a 75-kw, 2,300-volt, 60-cycle motor-generator set. The three-wire direct-current system of distribution is used, and to maintain a balance between the two sides of the system a pair of 7.5-kw balancers are operated.

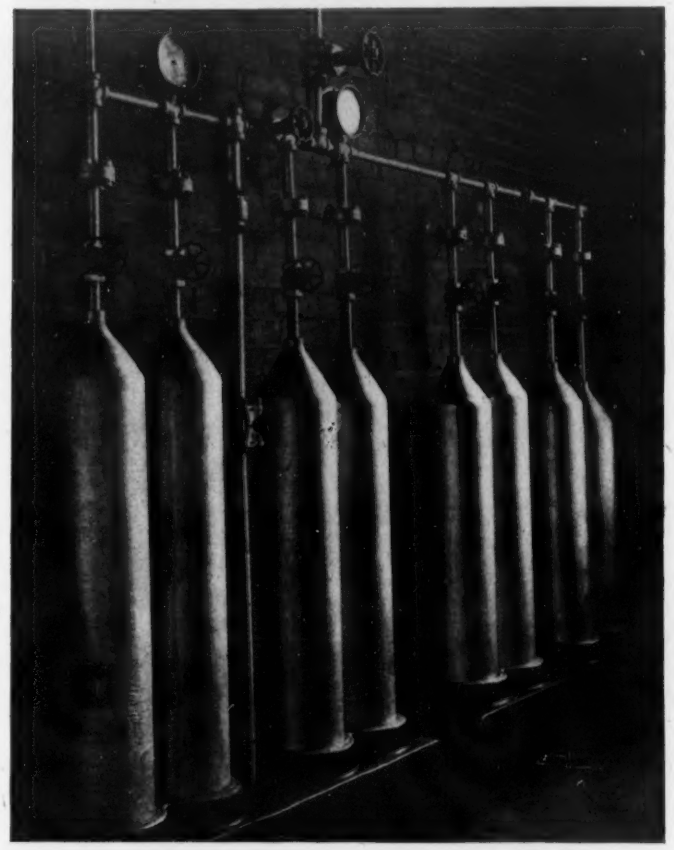


FIG. 2.—COMPRESSED AIR BOTTLES.

As the Diesel engine is somewhat of a novelty in central station work, it may be well to explain that this engine in principle is somewhat similar to a gasoline engine, as it derives its power from the explosion of vaporized oil in its cylinders. Unlike the gasoline engine, the fuel is ignited, not by a spark or flame, but by being compressed to such a pressure that when mixed with air in the cylinder it will explode by the heat of compression. For this reason it is necessary to provide with each of these engines a 20-hp belt-driven compressor, one of which can be seen in the background in Fig. 1. These compressors are capable of working up to 1,000 lb. per sq. in., and maintain pressure in a row of compressed air tanks of steel bottles shown in Fig. 2. When the

writer visited the plant at 3.30 p.m. pressure on these bottles was 57.5 atmospheres, or 845 lb. per sq. in. This air is used to atomize the fuel oil injected into the engine cylinders, which is pumped by a small pump mounted on the engine. The governing of the engine is accomplished through the medium of this pump, which has one piston for each engine cylinder. Each pump piston injects the proper amount of fuel oil into its engine cylinder at the beginning of each effective stroke. The governing of the engine under variations of load is accomplished by varying the valve closing which determines the effective stroke of this little oil pump. The engine governor is connected to the oil pump in such a way that the valves of the oil pump do not find a seat until a point in the oil pump stroke has been reached which will inject the proper amount of oil into the cylinder.

The compressed air is also utilized in starting the engine. For starting purposes, two of the compressed air tanks are opened up through a large pipe line directly to the starting valve in the left-hand cylinder seen in Fig. 3. After the engine has made a revolution, the explosion takes place in one of the other cylinders so that the compressed air is no longer needed and is shut off.

To provide for operation in case one engine should be disabled and the compressor on the other engine should be disabled at the same time, there is a 20-hp motor so placed that it can be belted to one of the compressors. The compressors are water-jacketed and water is circulated through them most of the time by gravity, cooling tanks being provided outside of the building. If circulation by gravity is not sufficient, the ½-hp motor shown in Fig. 4 can be used. This motor, however, is ordinarily used to drive another pump raising oil from the fuel oil tanks outside the building into the measuring tanks inside the building. These measuring tanks are shown in Fig. 5. These tanks can also in emergencies be filled by the hand pump underneath. They have float gauges which are read hourly. The sum of these measurements is checked by measurements taken in the large oil tanks

FIG. 3.—STARTING VALVE AND OTHER DETAILS.

outside the building. These outside storage oil tanks are located in separate brick compartments below the surface of the ground. There are two such tanks, each of 7,600 gal. capacity. A compartment was provided for a third tank, which would have been necessary had steam engines been used. For cooling the circulating water for the air compressors, two 10,000-gal. water tanks and a cooling tower are provided. Besides these there is a cistern under the cooling tower made of brick and cement lined.

ENGINE PERFORMANCE.

The operation of these engines has been very satisfactory. They have, of course, required somewhat better grade of attendance than steam engines, as it is not as easy to get good men to

FIG. 4.—PUMP FOR FUEL OIL OR CIRCULATING WATER.

operate Diesel engines owing to the newness of the type as to operate steam engines. The operation of the plant has been fully as reliable as that of a steam plant. The engines govern as perfectly as steam engines, and the generators are operated in parallel without difficulty. The engine is free from most of the troubles which beset gas and gasoline engines because it does not have the most troublesome feature of the gas engine—the

FIG. 5.—MEASURING TANKS FOR FUEL OIL.

igniter. The inside of the cylinder takes a high polish, and there is no apparent deterioration because of the high cylinder temperature. The lubrication is by means of a heavy engine oil which is placed in the crank case, the cylinder being lubricated by a splash from the crank case. The crank case is filled with water to a certain height and the oil is poured in on the water to a certain height. This height is maintained constant from day to day, and at long intervals the whole crank case is cleaned

out and fresh oil put in. The amount of fuel and lubricating oil required to operate these engines in actual service from September, 1905, to April, 1906, is shown in the following table:

	Sept. 1905.	Oct. 1905.	Nov. 1905.	Dec. 1905.	Jan. 1906.	Feb. 1906.	Mar. 1906.	Apr. 1906.	Aver.
Gals. fuel oil—	4454.5	5123.5	5186	5463	5201	4471	4977	4850.5	
Gals. engine oil—	44.5	0	0	0	14	0	8	2	8.5
Gals. compressor oil—	3.0	15	2.5	7	5	0	4	6	5.3
Crank case oil—	192.5	92	88	98	141	68	88	43	101.31
K.W.H. per gal. fuel oil—	9.56	9.33	9.49	10.1	9.33	10.01	9.15	8.9	9.433
K.W.H. output—	42,600	47,790	49,260	55,200	48,530	44,790	45,530	43,100	

Fuel oil costs at Sherman, in the tanks at the power house, 2 cents per gallon, so that the cost per kw-hour for fuel in this plant is about .02 cent. The regular performance of these engines as shown by the table corresponds very closely with the acceptance test, which showed a consumption of 9.41 kw-hours per gallon of oil. From the experience at Sherman there seems to be no doubt as to the satisfactory operation and economy of this type of engine. The first cost is considerably higher than for a steam engine plant, as the cost of these 225-hp engines is about $15,000.

As can be judged from the foregoing, Mr. R. B. Stichter, general superintendent and chief engineer, who has installed and operated this plant, has kept very close records on station performance. Recording wattmeters are provided to measure the total alternating-current and direct-current output. There is a double check on fuel oil measurements, as the oil is measured in the 50-gal. measuring tanks and also in the large tanks outside the building.

The Plant of the Great Northern Power Company of Duluth, Minn.

BY F. M. FEIKER.

PRESENT-DAY electrical engineering makes for simplification in power plant design. The general trend is toward generating units and auxiliary apparatus of large capacity rather than the multiplication of smaller machines. This fact was never better illustrated than by the water power plant at Duluth, Minn., now under construction for the Great Northern Power Company. Of the power schemes now under way, the scope of the plans of this company is second only to those at Niagara, and when fully carried out will call for the transmission of 200,000 hp to an ever-widening circle of users.

The plant which is now under way will have an initial equipment for 30,000 hp, with an ultimate capacity in this station of 80,000 hp. Power from the plant will be transmitted 14 miles to Duluth and Superior, where sub-station equipment will be provided. The future development can be surmised from the strategic position of the generating stations. Fifty to seventy-five miles to the north of the plant lie the Mesabi and Vermilion iron ranges, where the greatest iron mines in the world will undoubtedly be electrically operated. To the west along the southern shore of the lake, within transmission distance, are the Gogebic Crystal Falls and Gogebic iron ranges and the copper mines of the Calumet district. Electricity has already been contracted for by the railway, lighting and power companies of Duluth and Superior, and the long harbor frontage of docks and wharves can be equipped with electric hoists, lamps, etc. At the head of the lakes there is an enormous transfer of freight between steamships and railroad. The tonnage entering Duluth, Superior and Twin Harbors for the year 1905 amounted to 25,000,000 tons, which is more than that from the port of New York.

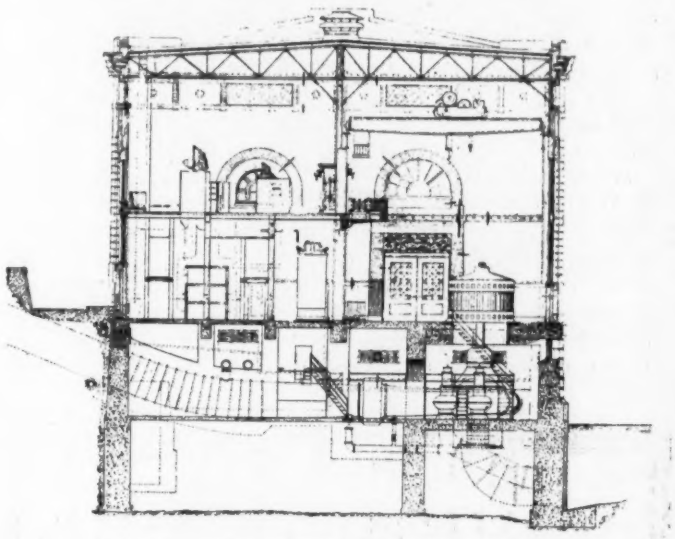


FIG. 2.—CROSS-SECTION OF POWER HOUSE.

The relative positions of the power house, dam reservoirs, etc., are shown in Fig. 1. From the headgates to the power house is a distance of 2.8 miles, about two miles of which is canal and forebay. Over the remaining distance the water is carried through about 3,800 ft. of wood stave pipe and about 1,000 ft. of 7-ft. steel pipe for each water wheel unit. The difference in elevation between the forebay and the power house is 378 ft.

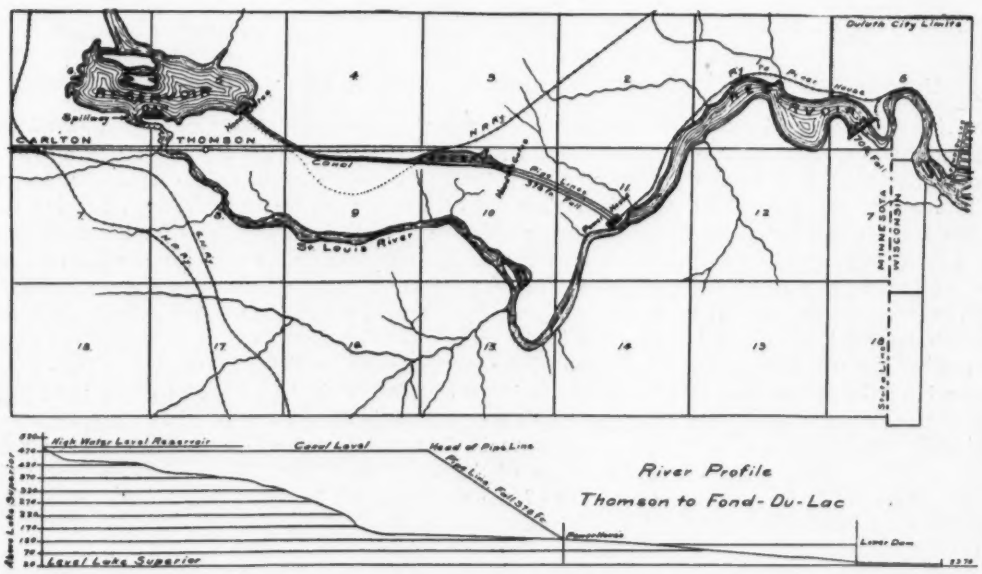


FIG. 1.—MAP SHOWING HYDRAULIC DEVELOPMENTS.

The building is constructed of brick masonry with steel framing and the architectural design adopted is handsome and appropriate for a power house. The present structure will be 181.5 ft. long and 77 ft. wide, provision being made to extend the length of the building to 313.5 ft. for the accommodation of the subsequent generating units. Within the layout is exceptionally compact and well arranged. On the main floor above the wheel pits are located the generators, exciters, transformers and switching compartments. The arrangement is shown in Figs. 2 and 3. The generators are grouped on one side of the building; in the center are the main step-up transformers, and on the opposite side from the generators are the high-tension bus-bars, oil switches, lightning arresters, etc., arranged in fire-proof cement compartments. Each transformer compartment is hung with removable steel doors, and tracks are provided upon which the 7,500-kw, three-phase units, to be described, can be rolled out on the main floor under the 60-ton crane which serves the generator side of the building. All low-tension wiring is laid in

floor ducts and the high-tension wires are carried on insulating supports beneath the cement floor. In that part which will eventually be the center of the building are two water wheel-driven exciter units, with space provided for duplicate motor-driven sets.

The switchboard also occupies the center of the building on a gallery or mezzanine floor, from which the entire station can be seen at a glance. Back of the board, on the same level, are the low-tension bus-bars and oil switches. Every switch is arranged for remote control from this benchboard, there being no heavy current wiring on the board. The interior of the power company's building is finished with white and buff brick with white enamel tile for a height of 7.5 ft. from the floor. In keeping with this, the switchboard is handsomely framed in double iron columns and ornamental cornice.

The initial hydraulic apparatus consists of three turbine water wheel units, each of 13,000 hp maximum output. The water wheels were built in Milwaukee by the Allis-Chalmers Company after designs of the Escher-Wyss Company, of Switzerland. The generators are mounted on an extension of the vertical shaft of the water wheels. Each consists of a 7,500-kw, three-phase, 25-cycle, 6,600-volt General Electric machine of the vertical type similar to those built by the same company for the power station at Niagara Falls. These generators are of the revolving-field type, and run at 375 r.p.m. The armature frame is so proportioned that the laminations and bar windings will be supported with practically no deviation from a perfect circle. The field spider is designed to withstand stresses induced by twice the rated generator speed, the spool windings being firmly clamped between the pole tip and yoke to prevent vibration or danger of loosening under centrifugal force. Ventilated collector rings are provided and the construction is such that they can be easily removed and cleaned. Carbon brushes are used to prevent cutting the collector rings, the whole field current supplying device being located in an accessible position. The total weight of the revolving field is carried by the step bearings, and the hydraulic thrust piston of the water wheel, the upper bearing of the unit serving merely to keep the revolving parts in alignment. This guide bearing is 15 in. in diameter and 30 in. long, and is split so that it can be easily removed. Lubrication is provided from a detached circulating oil system.

Each generator is rated at 7,500 kw at 375 r.p.m., but will deliver continuously 821 amp. at 80 per cent power factor, at rated speed and at a potential of 6,600 volts. The rise in potential when a non-inductive load is thrown off is guaranteed not to exceed 8 per cent with constant speed and excitation. Exceptionally high efficiencies have been obtained for these generators, the actual efficiency under test, including total losses for windage and friction, being 97.5 per cent. The total weight of the generator, including field, stationary armature and bedplate, is approximately 212,000 lb.

Excitation current for the generators is furnished by separate water wheel-driven vertical exciter sets, each having a capacity of 250 kw. Two machines will be provided which will take care of the eight main generators eventually to be installed. Each wheel is of the impulse type, of 500 hp capacity. The generators follow the standard lines of direct-current construction. Each is an eight-pole, 125-volt machine running at 500 r.p.m. and designed to withstand a speed of 1,000 r.p.m. The total weight of each machine is 16,200 lb.

Current from each of the main generators will be delivered to a single transformer, the largest three-phase, high-voltage transformers ever built. Each transformer has a capacity of 7,500 kw, and together with the generating unit emphasizes the statement made in the opening paragraph regarding the concentration of power. Because of their large size, these transformers embody several new and interesting features of design. While designated as water-cooled, oil-insulated transformers, these terms have a new significance in this design.

No water enters the containing tank of the transformer, but the heat is taken from the oil in a specially designed surface cooler outside the transformer case. The warm oil is drawn from the transformer through this cooler by a pump which also delivers the cooled oil to a compartment in the base of the core from which it rises through the core and windings, keeping the temperature within the fixed limit of a 35° rise for a normal run. The oil in the transformer tank then rises to the level of an overflow pipe through which it again returns to the cooler. This overflow pipe is equipped with a safety valve which closes if the oil level in the tank falls below that fixed as essential for proper insulation of the transformer. Fresh oil is supplied to the system from a tank located above the highest level of oil in the transformer. This supply tank is always connected to the system and an oil pressure is thus maintained which is much greater than the pressure of the water used in cooling, and so precludes the possibility of the transformers being injured by water entering the oil pipes.

Owing to the enormous weight of the core and windings (about 65 tons) the supporting framework of these transformers follows the principles of bridge design, the core and windings being hung from the cover by an arch construction so that they may be lifted bodily from the oil. (See Fig. 5.)

The transformer windings are arranged to step up the generator voltage (6,600 volts) to 30,000 or 60,000 volts for transmission as may be used. Each transformer is placed in a separate fireproof, air-tight compartment and the low-tension leads are car-

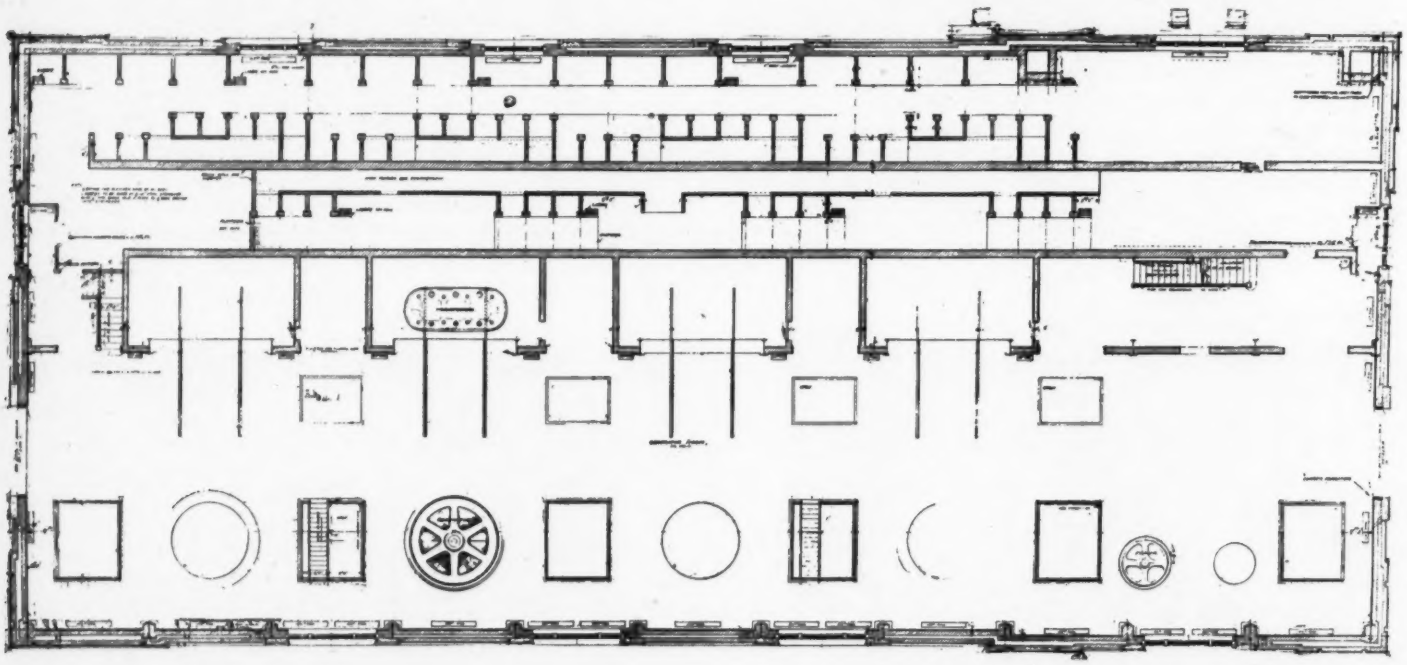


Fig. 3.—Plan View of Power House, Showing Arrangement of Apparatus.

ried to the transformer from the controlling oil switch, through wall insulators in the side wall of the transformer compartment, while the high-tension leads pass out the back through wall insulators. The cooling water for the transformers will be pumped from the Saint Louis River.

For indicating the comparative size of this transformer, a man is shown in Fig. 6. The over-all dimensions of each Great Northern transformer are 14 ft. 10 in. high, 14 ft. long and 5 ft. 10 in. wide. The total weight is approximately 171,000 lb., 4,800 gals. of oil being required for insulation. Six transformers will

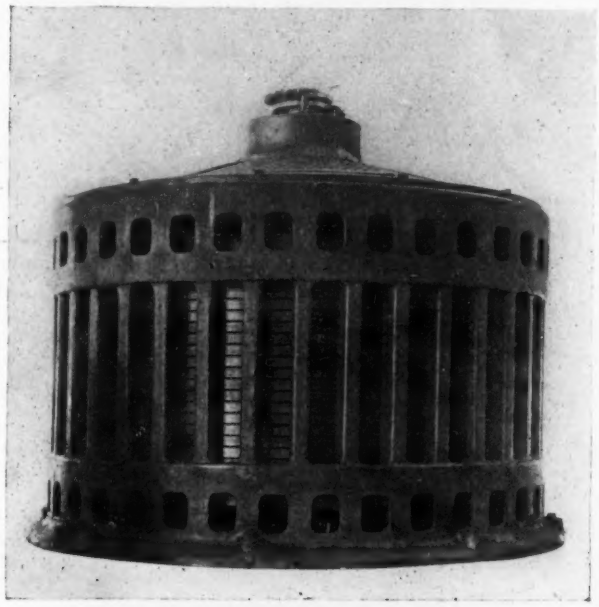


FIG. 4.—REVOLVING-FIELD GENERATOR.

be installed, three at the generating station and three at the receiving end of the line in the sub-station in Duluth.

The general scheme of wiring for this station embodies the most modern practice. All main alternating-current switches are of the

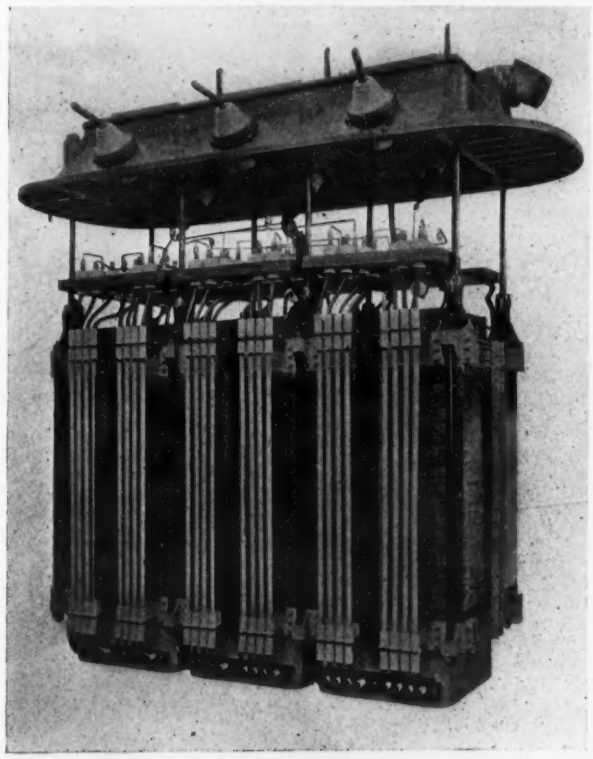


FIG. 5.—INTERIOR ARRANGEMENT OF 7,500-KW, THREE-PHASE TRANSFORMER.

General Electric oil type arranged to be electrically operated from a distance. They are designed so that they will open in event of a short-circuit with the entire completed plant in parallel. Air switches are employed to disconnect oil switches or to separate one part of the equipment from another, but they will never be opened under load. The precautions against interruption of service are very complete. The high-potential, 60,000-volt transmission lines are connected to the high-potential bus-bars by oil switches which will automatically cut out a short-circuited line

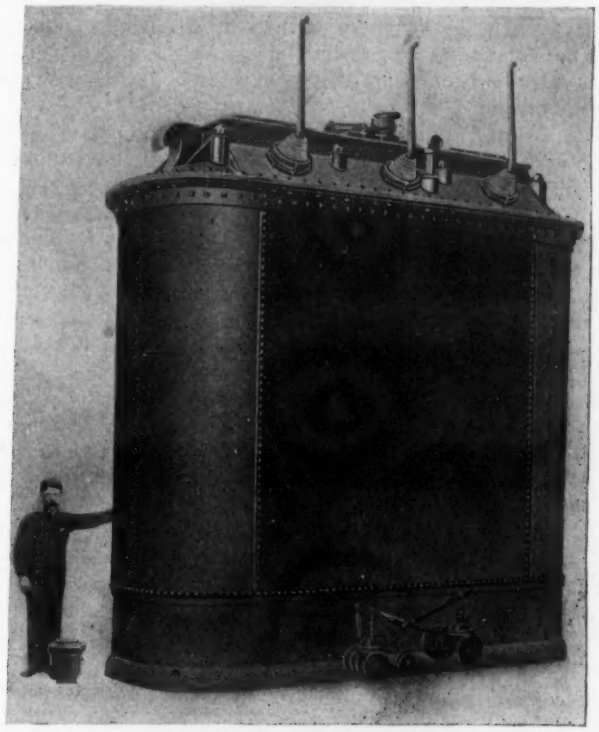


FIG. 6.—EXTERIOR VIEW OF 7,500-KW, THREE-PHASE TRANSFORMER.

when three or more lines are in parallel at both ends without interrupting the service over the remaining two or more lines. Fire-proof barriers and careful isolation of units almost absolutely prevent accidents.

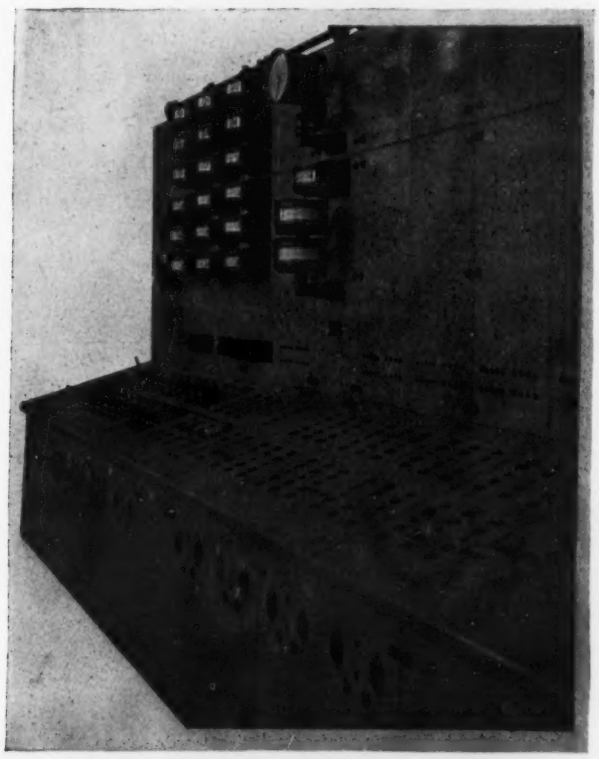


FIG. 7.—ALTERNATING-CURRENT AND DIRECT-CURRENT SWITCHBOARD.

The whole switching equipment is operated by remote control from a benchboard complete with indicating switches, instruments, etc. A few panels of this board are shown in Fig. 7. The instrument transformers are housed in separate compartments following out the cellular construction universally em-

ployed, so that there is no high-tension wiring of any nature on the operating board. The general arrangement of the complete board will be as follows: At the center is a station lighting panel, on the ends the panels for the motor-generators and water wheel-driven exciters, and between these end panels and the center panel, four generating panels governing the operation of the eight generators with their respective transformers. The compactness of the entire switching arrangement can be understood when it is stated that the entire switchboard for controlling 80,000 hp when completed, will be less than 19 ft. in length.

At present two transmission circuits operating at a potential of 60,000 volts will run to Duluth on a steel tower line. The towers will be spaced 400 to 500 ft. apart and have a central extension carrying a steel cable, the same size as the conductors, for lightning protection. Single-pole lightning arresters, each with a choke coil and a disconnecting switch, all mounted on porcelain bases, are provided for each conductor.

The sub-station at Duluth, which is most complete, is planned with a view to compactness and best operating conditions. Here, too, æsthetic considerations are given prominence, and the switchboard is placed in an attractive setting of columns and wrought-iron work. At Superior the Great Northern Power Company is installing sub-station apparatus in a station owned by the Superior Water, Light & Power Company. This company will purchase electricity from the Great Northern Power Company and sell to its own consumers.

The entire electrical equipment of the plant is being furnished by the General Electric Company, under plans and specifications furnished by Mr. F. O. Blackwell, consulting engineer of New York. The general scheme of the Great Northern development originated with Mr. F. A. Cokefair, of Duluth, and has been ably executed by the National Contracting Company under Mr. Cokefair's direction as chief engineer.

The Effect of Diffusing Reflecting Coatings on Glass Prismatic Reflectors.

By Major E. L. Zalinski.

Some question has recently been raised in the technical press as to the value of a coating of white enamel on clear glass prismatic reflectors. All the data so far presented on this subject by Mr. E. Leavenworth Elliott,* who has brought this matter up, have been unsatisfactory and inconclusive, because they have failed to compare reflectors of exactly similar shapes and dimensions. The following tests, quoted from a series of photometric measurements made by the Electrical Testing Laboratories of New York City, present evidence which is not open to such criticism.

The results given in Table I were obtained with a wireless cluster of three 16-cp standard oval anchored filament lamps, the cluster being backed in each case by a reflector 13½ in. in diameter and 140° in aperture of opening. As shown by the table, some nine different reflectors were tested. One was of smooth, white opal glass. Three were of clear glass, smooth on both sides. Of these three, one was left clear, the second was coated with white enamel on its upper surface and the third was similarly coated on its under surface. Two similar clear prism glass reflectors were also coated with white enamel, one on the prism side and one on the smooth side. This last coating came out of the oven somewhat dim instead of glossy, as were all the others. Photometric measurements were also made with a similar clear prism glass reflector. Thus there was obtained material for measurements from which could be deduced the value of the different elements, as shown in Table I. The mean zonal candle-power mentioned in the table is for the zone included in the circle 75° from the nadir or vertical, which is usually considered as the zone of useful light.

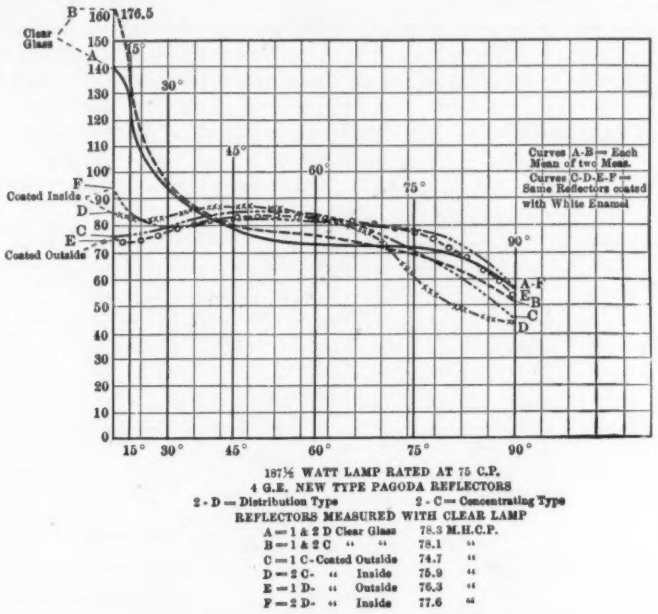

Clear Glass
Coated Inside
Coated Outside
Curves A-B — Each Mean of two Meas.
Curves C-D-E-F — Same Reflectors coated with White Enamel
187½ WATT LAMP RATED AT 75 C.P.
4 G.E. NEW TYPE PAGODA REFLECTORS
2-D — Distribution Type 2-C — Concentrating Type
REFLECTORS MEASURED WITH CLEAR LAMP
A — 1 & 2 D Clear Glass 78.3 M.H.C.P.
B — 1 & 2 C " " 78.1 "
C — 1 C-Coated Outside 74.7 "
D — 2 C- " Inside 75.9 "
E — 1 D- " Outside 76.3 "
F — 2 D- " Inside 77.6 "

FIG. I.—DISTRIBUTION AND CONCENTRATION OF LIGHT BY DIFFERENT REFLECTORS.

With respect to this zone, there are obtained among others the following conclusions: The gain in mean zonal candle-power by the use of prisms as compared with the smooth glass is 18 per cent, while the gain by the use of the enamel instead of prisms is 19.4 per cent. The gain by the use of the prisms alone and by the white enamel alone are, therefore, nearly equal. The gain of the prisms and enamel combined is 37 per cent over smooth clear glass and 16 per cent over clear prism glass. These gains do not give indication of the improvement of illumination due to better distribution of the light with the coated prismatic reflectors. In the class of reflector upon which these tests were made, namely, those with wide angles, the result of the coating is to give less variation in candle-power between maximum and minimum values over the area covered by the reflector. Thus in a certain area to be lighted, adjoining lamps and reflectors are more inter-helpful, a point of considerable practical value.

The Rousseau diagram reproduced in Fig. 1 shows the results of tests on the new Holophane reflectors used on the General Electric high-efficiency incandescent lamp. A 187.5-watt, 75-cp lamp was used. Reflectors of both the distributing and concentrating types were used, and the results are as indicated in the diagram in Fig. 1. The notable point in these measurements is that while clear prism glass reflectors give the highest meas-

Table I.—Photometric Measurements of Various Reflectors 13½" Diameter, 140° Aperture, with Cluster of 3.16-cp Oval Filament Lamps.

	Angle.	Test A. Cluster Alone.	Test B. Plain Glass Uncoated.	Test E. Plain Glass Upper Surface Deadened.	Test C. Plain Glass Enameled Inside.	Test F. Enameled Inside Upper Surface Deadened.	Test D. Plain Glass Enameled Outside.	Test I. Clear Glass Prismed.	Test G. Enameled Outside.	Test H. Enameled Inside.	Test J. Opal.
	90 deg.	34.9	35.5	35.0	37.8	35.0	37.6	....	41.8	35.6	....
	75 "	37.9	37.8	37.7	42.9	39.1	42.1	42.5	47.3	44.0	43.1
	60 "	39.3	42.2	41.3	49.7	44.6	49.3	45.3	57.2	52.9	51.8
	45 "	41.7	48.7	44.7	57.9	50.6	56.5	55.3	65.5	62.7	59.0
	30 "	44.7	48.5	45.7	60.9	53.5	59.4	63.9	68.8	67.2	65.1
	15 "	46.6	48.3	46.5	63.0	54.6	62.1	69.0	73.1	69.2	68.1
	0 "	48.0	48.6	47.2	63.4	56.0	62.1	69.2	73.8	71.0	67.2
M. Hemispherical CP.	90 "	40.1	42.7	41.2	50.4	44.0	49.3	....	57.0	53.4	....
M. Zonal CP.	75 "	41.4	44.8	42.9	54.0	47.8	53.0	52.9	61.4	58.1	54.3

* *Illuminating Engineer*, May, 1906. Plain versus Enameled Prismatic Glass Reflectors.

urements at the vertical and adjacent angles, the diffusing or coated reflectors give the highest measurements at 45° from the

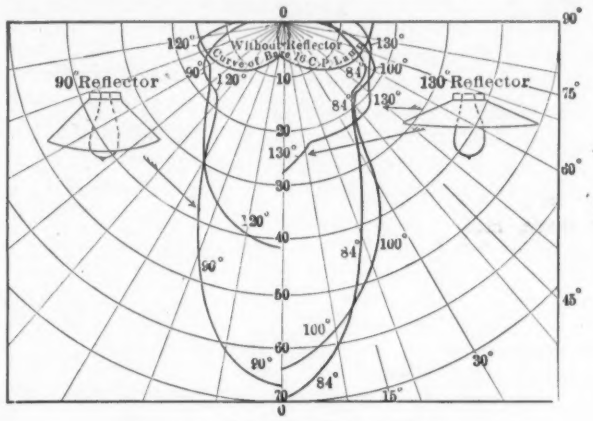


FIG. 2.—ILLUMINATION CURVES.

vertical. This bespeaks a much more favorable distribution for securing an equable illumination, thus giving a higher intensity

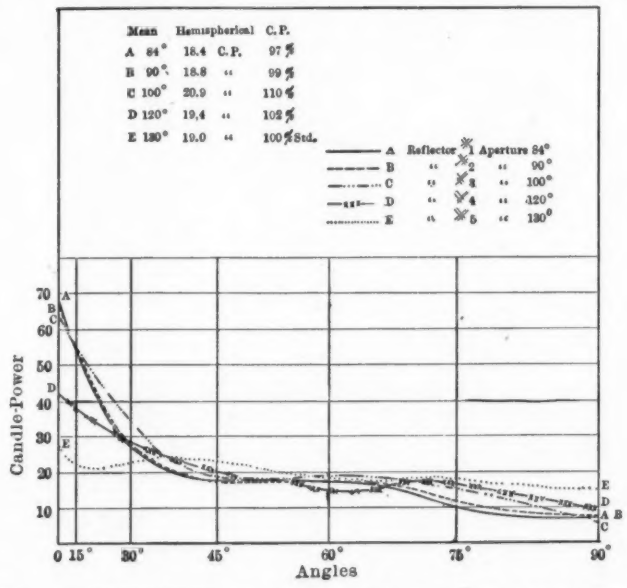

Mean Hemispherical C.P.
A 84° 18.4 C.P. 97%
B 90° 18.8 " 99%
C 100° 20.9 " 110%
D 120° 19.4 " 102%
E 130° 19.0 " 100% Std.
A Reflector 1 Aperture 84°
B " 2 " 90°
C " 3 " 100°
D " 4 " 120°
E " 5 " 130°
Candle-Power
Angles

FIG. 3.—DISTRIBUTION OF LIGHT ABOUT A 16-CP LAMP USED WITH VARIOUS REFLECTORS.

for illuminating the more distant points. Another notable point is that the variations in maximum and minimum candle-power is

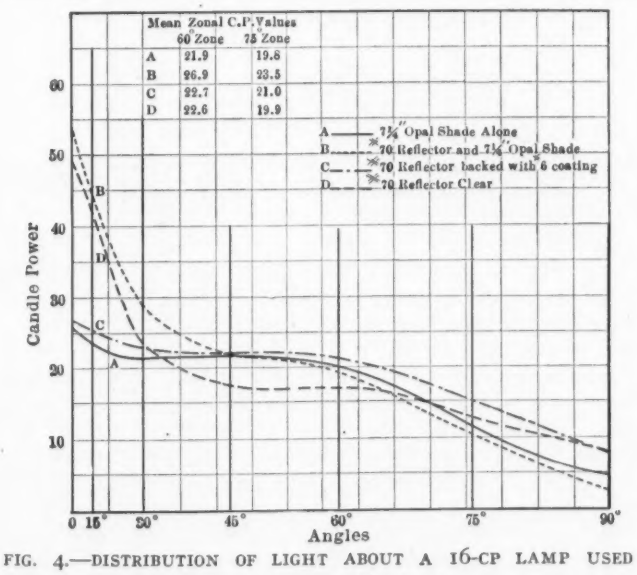


FIG. 4.—DISTRIBUTION OF LIGHT ABOUT A 16-CP LAMP USED WITH VARIOUS REFLECTORS.

as 1:3.75 for the clear glass reflector while it is as 1:1.9 for the white enamel coated reflector of similar class.

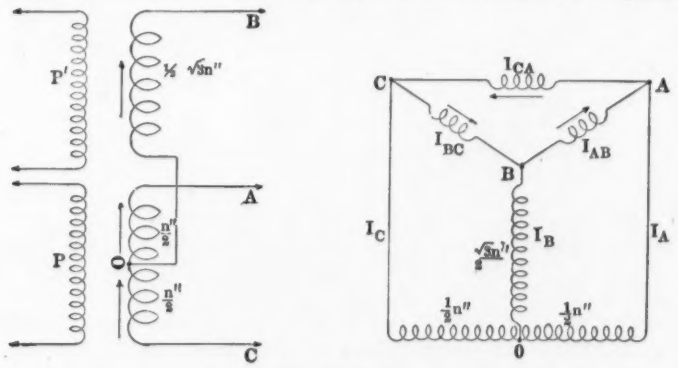
In this connection the writer wishes to call attention to the false impression that photometric curves are apt to give the novice. Such an observer is apt to be deceived by the depth of the curve at the vertical and adjacent angles. The Rousseau system shows the values at the different angles in their true proportions since the area enclosed by a Rousseau curve represents the total useful flux of light. A very deep but narrow photometric curve bespeaks only small values for real illumination except for a small spot directly under the lamp and reflector, which small and very bright spot will appear in juxtaposition with contrasting zones of less intensity. Of course, if the object to be illuminated is a considerable distance removed, then the plain glass prismatic reflector may be of some value in such special cases, while it is of very little value for general illumination. A relatively small superiority in candle-power at the higher angles, say, at 45° and upwards, will more than counterbalance a greater magnitude at zero and adjacent angles up to 30°. The writer has made numerous measurements of illumination obtained with clear prism glass reflectors and diffusing reflectors of many shapes and dimensions, and has yet to find a case where the clear prism glass reflector secured a better distribution and at the same time markedly higher mean values.

Load and Power Factor Relations in Two-Phase to Three-Phase Transformers.

BY F. A. FISH AND ADOLPH SHANE.

IT is the purpose of this article to establish by vector diagram the proof that on balanced secondary load the primaries of two-phase-three-phase transformer circuits are also balanced as to load and power factor.

If the primaries of two transformers having the same rated pressure are connected one to each phase of a two-phase source of e.m.f. and if the secondary of one with 0.866 (i. e. ½ √3) of the rated pressure of the other secondary, be connected to the middle point of this other, there will result a transformation from two-phase to three-phase e.m.f's. If three-phase e.m.f's are impressed on what was the secondary in the above, two-phase currents may be obtained from the other windings. For example, if in Fig. 1, the primaries, *P* and *P'*, are connected to a two-phase source of e.m.f's, and if the secondary, *BO*, with 0.866 of the turns of the secondary, *CA*, be tapped to the middle point of the windings of *CA*, at *O*, the e.m.f's at the terminals, *AB*, *BC* and *CA*, will be equal in value and any one will be 120° out of phase



FIGS. 1 AND 2.—DIAGRAMS OF TRANSFORMER AND OF DELTA-CONNECTED LOAD CIRCUITS.

with each of the other two. In the following discussion the three-phase side will be considered the secondary.

In the analysis of current relations relative to the respective e.m.f's consider Figs. 2 and 3 where,

E_{AB} = the e.m.f. between terminals *A* and *B*,
E_{BC} = the e.m.f. between terminals *B* and *C*,
E_{CA} = the e.m.f. between terminals *C* and *A*,
I_{AB} = current in load connected between terminals *A* and *B*,
I_{BC} = current in load connected between terminals *B* and *C*,
I_{CA} = current in load connected between terminals *C* and *A*,
I_A = current in line *A*,
I_B = current in line *B*, and
I_C = current in line *C*.

Further, let the positive direction of currents in loop *A C B A*

of Fig. 2, which represents a balanced three-phase load delta connected to the terminals of the secondaries, be in a counter-clockwise direction.

In Fig. 3 the current vectors, I_{AB}, I_{BC} and I_{CA}, are shown lagging by the angle Θ behind their respective e.m.f. vectors, E_{AB}, E_{BC} and E_{CA}. The line current vectors, I_A, I_C and I_B are also shown in their correct angular positions and to scale, each one being respectively the vector difference of I_{AB} and I_{CA}, I_{BC} and I_{CA}, and I_{BC} and I_{AB}. This is true because in Fig. 2, at each junction, *A*, *B* and *C*, one arrow points towards the junction and the other away from it. *O B* (Fig. 3) is the vector representing the e.m.f. to scale and direction at the terminals of the secondary, *O B*, it being one of the components of the e.m.f., E_{AB}, of which *O A* is the other. Then from the figure it is seen that the current, I_B, flowing in this secondary, lags by the angle Θ behind this secondary e.m.f. This is the angle of lag of the current in the load of each phase behind the respective e.m.f. Since the primary current follows the variations of the secondary (both as to phase and value) in the local transformer, the power factor of the primary, *P'* (Fig. 1), is the same as the power factor of the balanced loads on the secondaries.

The ampere-turns on the secondary, *O B*, are $\frac{1}{2}\sqrt{3}\,.\,N I_B$. It is drawn to scale in Fig. 3 following the direction of I_B. The counterpart of these ampere-turns is found in the primary, *P'*.

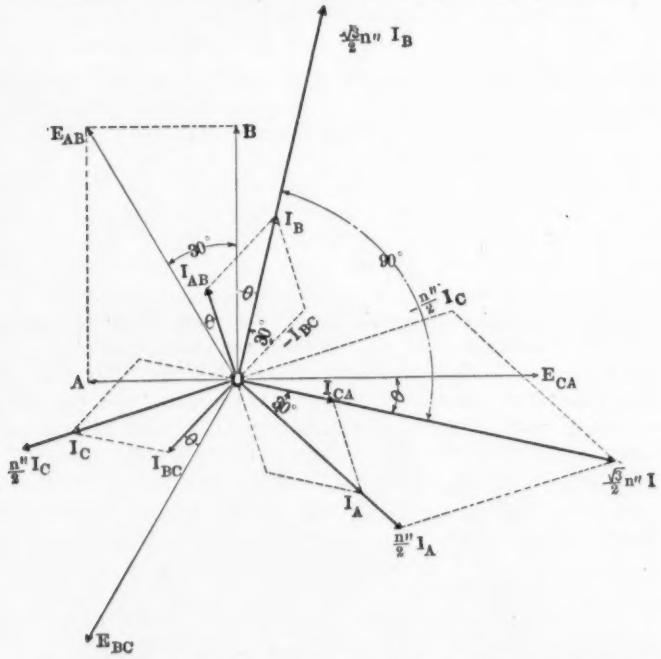


FIG. 3.—VECTOR REPRESENTATION OF TWO-PHASE AND THREE-PHASE QUANTITIES.

Next, considering the secondary, *C A*, it is seen that the resulting ampere-turns are made up of two parts, $\frac{1}{2} N I_C$, and $\frac{1}{2} N I_A$, equal in value. The vector difference of these gives the resultant ampere-turns. Thus in Fig. 3 the vector, $\frac{1}{2} N I_C$, drawn to scale and direction, was inverted and the resultant obtained by combining with the vector, $\frac{1}{2} N I_A$, producing the new vector, $\sqrt{3}/2\ N I$, equal in magnitude to the vector representing the ampere-turns on the secondary, *O B*, 90° away from it, and the angle Θ behind E_{CA}, the e.m.f. of secondary *C A*. It is these resultant ampere-turns that have their counterpart in the primary, *P*, and vary with those of the primary.

Hence the two primaries are equally loaded, and each has the same power factor, that of the three-phase load. In much the same way the proof for a balanced star-connected load might be given, showing that in the latter case the above conclusions also hold true.

International Electrical Engineering Standardization.

Prof. F. B. Crocker and Mr. C. O. Mailloux will represent the American Institute of Electrical Engineers at a conference of European Electrical Societies at which international electrical standardization will be discussed.

The Elevated Conductor in Wireless Telegraphy.

By H. J. Round.

The elevated conductor known under the name of aerial or antennæ, has, during the ten years of development of wireless telegraphy, remained an essential feature of all Hertzian wave wireless telegraph systems. In dealing with free short waves in space, Hertz grasped thoroughly the action of the receiving and transmitting antennæ, and furthermore he studied minutely the forces at work round his radiators and absorbers.

No such thorough study of the forces and actions round the large grounded radiators and receivers has been made, and the development of the ærial has proceeded slowly by the experience method.

The first elevated conductors consisted of tin boxes, supported at a height and connected by wires to the instruments, but these were soon reduced to the vertical wires alone, as it was found that supporting large metallic surfaces at great heights introduced mechanical difficulties.

In the first experiments the vertical transmitting wire was connected through a spark-gap to ground, and the oscillation set up in it was the fundamental oscillation of the wire and ground system. In the receiver, however, the high-resistance coherer was placed between the lower part of the aerial and the ground, so that until the coherer was brought to a low resistance, the aerial to ground circuit was not complete. The instrument would, therefore, only respond to higher harmonics of the fundamental of the transmitting system.

Marconi remedied the defect by the introduction of the oscillation transformer, and shortly afterwards Slaby accomplished the same result by means of his multiplier.

Hertz, in his experiments, used as a receiving circuit an almost closed turn of wire (Fig. 1), the ends, *B* and *C*, being brought near together for the purpose of measuring their potential difference; this is the same thing that the coherer measures.

Hertz's turn can be split by the horizontal line representing the earth (dotted line *G G*, in Fig. 1), and the upper half gives us a representation of an aerial as he would have made it, for measuring the strength of the received signals by sparking between the point of highest potential, *B*, and the earth. The last

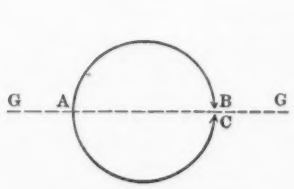


FIG. 1.—HERTZ RECEIVER.

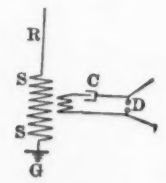


FIG. 2.—COUPLED CIRCUITS.

position should have been the coherer's position, whereas it was placed at *A*, which should obviously be connected to the ground.

Not much development in aerial wires occurred for five or six years. The number of wires in parallel was increased up to many hundred, as in the large power stations intended for transatlantic working. It was found, however, that after a certain number were up there was not much gain in efficiency, either in receiving or sending.

By this time, coupled circuits (Fig. 2) had come into general use. One circuit consisted of the radiating wire, *R*, in series with the secondary, *S S*, of a Tesla coil and ground, *G*; the other one, linked to the first by the primary of the Tesla transformer, was a closed or non-radiating circuit consisting of high-tension condensers, *C*, spark-gap, *D*, and the primary of the Tesla coil in series. On the amount of energy that could be stored in the condensers depended the strength of signals that could be radiated.

The time of one oscillation of the circuit containing the high-tension condensers is proportional to the square root of the product of the inductance and capacity of the circuit, and as this inductance cannot be decreased (it usually consists of the inductance of only one turn on the Tesla coil), it is necessary

to increase the time of oscillation as the capacity is increased, so that to get more energy in the circuit it was found necessary to increase the wave length of the radiated wave.

The aerial circuit has to be in syntony with the primary circuit to give good results, so that now either the inductance or the capacity of the aerial circuit had to be increased to bring it in syntony with the spark circuit. At first there seemed a very easy way to do this. The maximum capacity and length of aerial had, it was thought, been obtained, so the length of the secondary of the Tesla coil was increased till its length brought the aerial circuit into tune.

In order to see wherein this process was faulty, it is desirable to review Hertz's work. Hertz, when describing his receiver (Fig. 1) points out that the maximum wire current is at a position, *A*, opposite the spark-gap, and the current decreases towards the ends, from which radiate the maximum displacement current. In other words, the maximum magnetic effect is round the wire opposite the gap; this decreases rapidly towards the ends, but the maximum potential effect is at the ends, decreasing as one gets nearer the center. By dividing the ring by *G G* it can be seen where the positions of maximum current and potential are.

Poynting's theory of the transference of energy in the electromagnetic field states that the energy moves everywhere at right angles to the directions of the magnetic and electric forces and is in amount proportional, per unit surface passed through, to the product of these two forces if the latter are at right angles —if they are not the amount is found by multiplying by the sine of the angle between the forces. Remembering that along the lines of force the displacement or capacity currents are flowing, being a maximum when the magnetic force is a maximum, it is seen that the theory is similar to the old two fingers and a thumb rule for the motor or dynamo, direction of magnetic force, current and motion being at right angles, and if one can think of the displacement current along the line of force as a movable conductor, the theory of wireless telegraphy can be reduced down to the motor and dynamo theory.

This rule works out in the case of a vertical transmitting wire as follows:

The magnetic lines are in circles round the aerial, decreasing in number towards the top. The lines of force along which flow the displacement currents are practically parallel to the wire. The line at right angles to these two lines where they cross is evidently perpendicular to the wire, and parallel to the ground, which of course is the direction of radiation. The amount of radiation is proportional to the value of the product of the two forces.

To obtain maximum radiation one must get the maximum amount of both forces at right angles, and if that part of the aerial which gives the greatest magnetic force is boxed up as a closed coil the radiations are prevented, and this is what increasing the secondary of the Tesla coil does. Fortunately, another solution of the whole difficulty was obtained.

Suppose the upper half of a vertical aerial wire is bent down at right angles to the lower half, making an inverted L. There is very little alteration in the amount of the two forces that remain at right angles, as the electric lines still remain vertical, and the upper part of the aerial did not contribute much to the magnetic forces.

In wireless telegraphy the practical limit of height is about 200 ft., and for purposes of insulation it is better to erect wooden structures. If, therefore, instead of bending down the 200-ft. vertical wire, a horizontal piece as long as the vertical portion be added to the top, there will be obtained an aerial which is nearly equivalent in effect to a wire 400 ft. in height. At the same time it is now in tune with the longer wave, which it is desired to use.

These rough principles are all amply borne out in practice, and the facts were brought out by experiment. The extension of the inverted L principle gave of course two or more wires, the extensions pointing in different directions. These aerial wires can be seen at any station intended for working more than 100 miles at sea.

Many of these so-called extension aerials can be seen on the Atlantic liners and other ships. It was found in practice that the horizontal portions can be brought downward at a slight angle without an appreciable decrease in the effect, so that it is possible to erect such a system with only one mast, the extensions being guyed out with long ropes. The extensions can be made in length several times the height, although Marconi's recent work on directional wireless telegraphy shows that other effects come in if the ratio is made too large.

Not enough details have yet been published on this last development to express any opinion on the theory of the subject.

Suppose we take an aerial wire 200 ft. in height, and with several extensions 600 ft. in length spreading horizontally from the top. With a Tesla coil having a secondary length of about 100 ft., it would, on a rough estimate, have a wave length between 6,000 and 8,000 ft., and the capacity in the primary circuit would be of the order of a microfarad. This would mean the capacity of about 700 quart Leyden jars.

Such is the present status of the aerial wire, but there is no doubt that a closer study of the forces at work around both receiving and transmitting wires is bound to bring out new facts which are liable to be of immense use in wireless.

Electric Coffee Roasting in Germany.

Statistics show that the consumption of coffee in Germany is steadily on the increase, having been augmented 50 per cent during the past seven years. This is due, first, to the lowering of the price of coffee, and secondly, to the improved roasting of the bean, which minimizes the work of preparing the berry for consumption. Factory roasting has developed into a large industry, in fact it has almost entirely eliminated domestic roasting. Regarding industrial coffee roasting, an eminent authority, Mr. Trillich, of Munich, recently made this important observation: "While formerly an endeavor was made to protect the

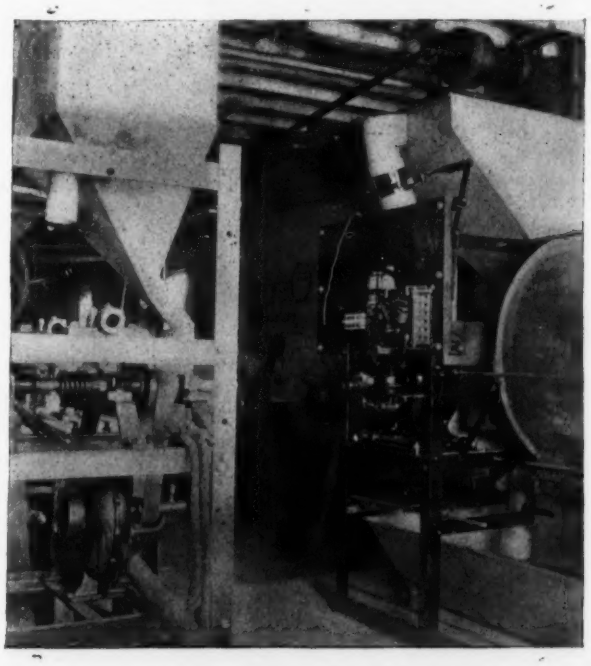


FIG. I.—ELECTRIC COFFEE ROASTER.

coffee as much as possible from the smoke and gases arising from the source of heat, even going so far as to construct the drum of silver, as the gas would not penetrate this as easily as drums made of other materials, machines are now constructed permitting the roasting gases to be sucked directly through the coffee. A decided retrogressive step, therefore, has been taken, in subjecting the coffee to the damaging influences of smoke and gases, especially sulphur, which seriously affect its flavor."

Theoretically, therefore, that method of roasting should have the preference, in which the coffee does not in the least degree come into contact with gases or any form of dust containing products of combustion arising from the source of heat. These requirements are fully met by the electric coffee roaster, which

has recently been developed in Germany. In this machine a number of resistance coils, consisting of strips of Krupp metal 2½ mm. thick, 5 mm. broad and 13½ m. long, wound on porcelain tubes, are heated to a red heat and these transmit the heat to the air within the drum, raising it to the temperature required for the roasting of the coffee.

While a decided improvement was expected from this new method of roasting, surprisingly good results have actually been

FIG. 2.—ELECTRIC COFFEE ROASTER.

obtained, as is shown by comparative chemical analyses, which have been made recently, in order to determine the relative values of electric versus coke roasting of coffee. These tests show that the electrically-roasted coffee contained 34 per cent more substances soluble in water, than that roasted by means of coke, as well as considerably more material soluble in ether, as is shown by the following table:

	Source of heat.	
Guatemala Coffee.	Electric.	Coke.
Material soluble in ether.....	19.11%	18.04%
Material soluble in water.....	37.04	34.35
Mexican Coffee.		
Material soluble in ether.....	18.91	18.43
Material soluble in water.....	39.20	35.84

Experts agree that the more material a coffee contains, which is soluble in ether, the better will be its flavor, and the more substances soluble in water it contains, the stronger it will be.

As there is no known method of expressing the "taste value"

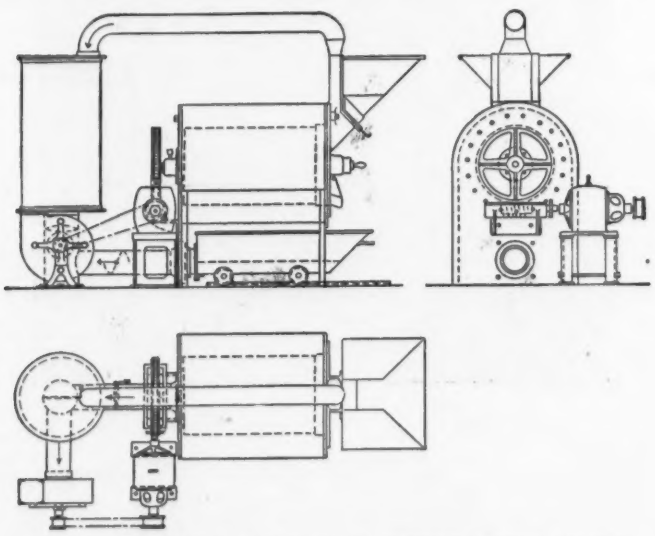


FIG. 3.—ELEVATIONS AND PLAN OF ELECTRIC COFFEE ROASTER.

of coffee in numbers, it was necessary to supplement the test by giving samples of each coffee roasted by the two methods to experts, and invariably the electrically roasted coffee was easily distinguished on account of its superior flavor and richness.

Coffee roasting is a far more delicate operation and must be performed with greater exactness than the uninitiated might imagine. but anyone may readily be convinced of this after observing a coffee roasting plant in operation. Not alone must the temperature of the drum be kept between the narrow limits of 200 and 220 degrees Cent., but the coffee beans must be constantly kept in motion; for a momentary stoppage of the drum would burn the beans. Furthermore, the beans must not be allowed to pack, and to prevent this, blades are placed within the drum, as shown. It is also essential that the heated and dust-laden air be withdrawn from the drum, and for this purpose a motor-driven exhaust fan is attached to the shaft. Another fan sucks the roasted coffee from the receptacle into which it drops after it has been roasted, into conveying tubes,

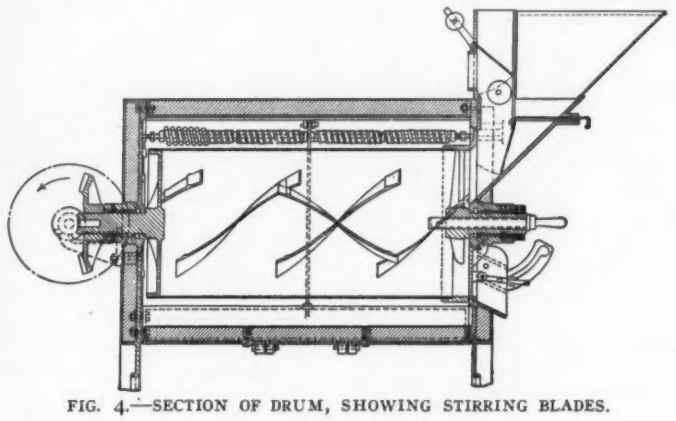


FIG. 4.—SECTION OF DRUM, SHOWING STIRRING BLADES.

from which it is delivered into bags. The air pressure is so regulated that all dust particles are directed into a special tank. The drum must be rotated at a fairly high speed, as slow roasting produces loss of aroma and forms damaging by-products. It may be of interest to state that beans loose from 15 to 30 per cent of their weight during the process of roasting, while they gain from 30 to 50 per cent in volume, due to expansion. The machine illustrated is the invention of Capt. Carl Moegling and has been in use throughout Germany for the past few years. The current consumption is about 25 kw, which may be considerably reduced by redesigning properly the electric heating equipment. It is well worthy of the serious consideration of the seventy-seven coffee roasting plants in the city of New York, as well as those elsewhere in the country.

New Telephone Patents.

SELECTIVE SYSTEM.

A new type four-party selective signaling system has been recently invented by S. A. Reed, of New York City. This introduces principles quite novel, in that the operation of the bells depends upon the wave form of the ringing current. The ringing machine is so designed that the wave sent out almost instantaneously reaches its maximum value and then gradually diminishes to zero. As the bells have in series with them condensers, it is evident that on the rising part of the wave the condensers become instantly charged, causing a considerable current impulse through the bell coils. On the descending part of the wave, however, the change of voltage is relatively so slow that the resulting current from the condensers through the bell is insufficient to overcome the normal tension of the biasing spring. Two bells are legged off each side of the line to ground. On each side one bell responds to a quick positive impulse and the other to a quick negative impulse.

TRANSMITTER SUPPORTS.

For hotel sets it is found most convenient to use an instrument, the transmitter of which projects a minimum amount from the base. In some instances a short transmitter arm has been used and in others the transmitter casing has been set flush with the face of the box. The disadvantage of the latter is, of course, the lack of adjustment, while its advantage lies in the shallow instrument.

S. A. Beyland, of Elyria, Ohio, has now invented a transmitter support which lies medium between these two former arrangements. He has made a slight extension on the rear of his transmitter casing and has adapted this to fit into a hemispherical

notch in the front of the box. This results in an adjustment equivalent to that of a short arm, and yet raises the transmitter from the face of the box considerably less than with the usual short arm.

Mr. Beyland has also invented a transmitter arm of the ordinary type for all sets. This is a hollow arm and the novelty lies in the base plate being hollow also. This base plate of pressed metal carries within it a terminal block, which is adapted to form the connection between the transmitter and the instrument wiring proper. This terminal block takes the cords from the transmitter and is adapted either to make automatically spring connections with the terminals of the instrument wiring in the normal course of mounting the transmitter upon the backboard, or to take the wiring of the set in binding posts upon the terminal plates. Both of these patents have been assigned to the Dean Electric Co.

NEW TRANSMITTERS.

Mr. W. W. Dean has patented a transmitter of the general appearance of the solid-back type, but he claims to have overcome many of the minor defects of the pure solid-back instruments. A

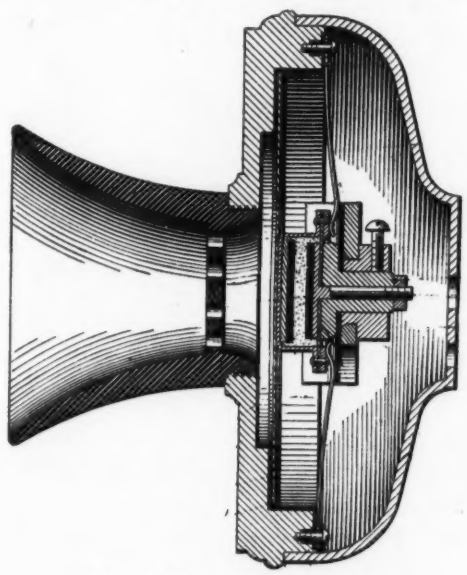


FIG. 1.—DEAN TRANSMITTER.

section of his transmitter is shown in Fig. 1. It will be seen that the rear electrode is held stationary, the containing case being mounted upon this electrode by means of an auxiliary mica diaphragm. The tension springs normally strive to drive the containing case forward against the normal tension of the auxiliary diaphragm, holding the front face of this case tightly against the transmitting diaphragm. It will readily be seen that there can be no side distortion in such a form of transmitter, and it is also possible for the transmitting diaphragm to take an extraordinary vibration without unduly straining the auxiliary diaphragm. Mr. Dean has assigned his patent to the Dean Electric Company, of Elyria, Ohio.

Mr. Franz Freyer, of Switzerland, has also patented a new transmitter. In his transmitter the diaphragm consists of a thin carbon plate, upon both sides of which are placed microphonic buttons. The front button has an aperture of a size similar to the size of the opening of the transmitter mouthpiece, and in the annulus about this opening a number of small cavities are drilled and then filled with carbon granules. The rear button is similarly constructed, except that it has no central aperture. The diaphragm acts upon both front and rear faces. The induction coil with such a transmitter is provided with two primary windings in reversed connection so that the two parts of the transmitter may work in unison.

REPEATER.

We have a patent for another attempt at the repeater problem, this the work of E. E. Clement, of Washington, D. C. It is Mr. Clement's idea that the former repeaters of the telemicrophone type have failed largely because of the bulky mechanical attachments. Mr. Clement has sought to make his receiving parts microphonic in their action and thereby cut out as much as possible the mechanical devices. He apparently has tried several means. One of these is to use magnetic particles coated with carbon by the flash or some other process, which particles he places directly in the receiving field, and are included in the electric circuit of the transmitting side of his instrument. It will thus be seen that received minute currents affect the receiving magnet in whose field the magnetic microphonic particles are placed, and these changing their contact pressures under the varying magnetic influence, affect the transmission of the magnetic circuit.

TRANSMITTING SYSTEMS.

Some time ago Mr. I. Kitsee, of Philadelphia, took out patents for a system of long-distance transmission in which each side of the line consisted of two twisted pairs of wires, one station being connected to one wire of a pair only, the actual connection between the stations being by electrostatic induction between the two wires of the pairs. It was claimed that a considerable gain in transmission was effected by this means. It will be seen at a glance that such a system would be most awkward for signaling through under the ordinary conditions. Because of this a special exchange system has been brought out by which each exchange is connected to both wires of each of the two pairs required for a circuit when the line is in condition for signaling. As soon, however, as the connections are made for talking purposes each exchange is severed from the proper one of the wires of both pairs.

Mr. Kitsee has obtained a patent for another transmission system with grounded return. In this system the induction coils are so designed that a most powerful secondary current is sent out on the line. This current is so powerful that it is claimed to overcome effectually the ordinary inductive ground disturbances which would be picked up by a long-distance line. Unfortunately, an induction coil of the proper dimensions has so high an inductance that two in the line, one at each end, effectually bar the receivers from the telephone currents. Mr. Kitsee has, therefore, devised an arrangement of his terminal stations so that the receiver is in a branch between a grounded artificial line and the main line, while his transmitting circuit is connected to the middle of a retardation coil which is bridged about the receiver. It will readily be seen that this arrangement throws the induction coil at the receiving end in a circuit separate from the receiver.

COMBINED JACK AND DROP.

Fig. 2 shows a sectional view of a new combined jack and drop of rather novel design. This is the invention of W. E. McCor-

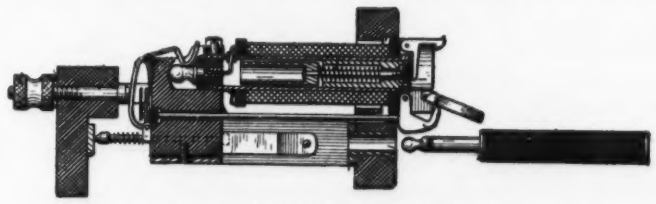


FIG. 2.—M'CORMICK SWITCHBOARD.

mick, of Chicago, he having assigned his patent to the International Telephone Manufacturing Company. It will be seen that the drop is provided with a plug terminal such that it may be inserted through the face of the board into a jack socket, exactly as though it were a switchboard plug. It is quite evident from the cut how the solenoid armature travels forward to release the drop shutter and how the plug passing into the jack kicks the armature back into place.

AUXILIARY LAMP FOR AUTOMATIC STATIONS.

It has been found difficult with such automatic systems in which the subscriber must operate a selector, to send in a call in the dark. Because of this, it has been found that some auxiliary form of lighting would be of convenience. T. J. Merryman and C. L. Allen, of Lincoln, Neb., have invented an auxiliary lamp controlled by a push button, designed to throw a light upon the selective switch sufficient for a user to determine the various numbers of the dial.

TELEPHONE SWITCHHOOK.

A few weeks since we noted a patent describing a novel way of making a switchhook out of a stamping of sheet metal. W. E. Frick, of Chicago, has now patented another kind of switchhook made of sheet metal, but turned up in a different way.

Mr. Frick stamps out a blank and then by giving the main shank a quarter turn and giving the legs of the "U" a sweep equivalent to a half turn, the sheet metal blank is readily formed into the customary switchhook shape. Mr. Frick has assigned one-half his patent to McMean & Miller, of Chicago.

Letters to the Editors.

Pike's Peak Hydro-Electric Plant.

To the Editors of Electrical World:

Sirs:—I have read the letter of R. M. Jones in your issue of June 14, concerning the water wheels at the power plant of the Pike's Peak Hydro-Electric Company, and tests made on the same by Mr. George M. Peek and the writer. As Mr. Jones is in the employ of the company which furnished the wheels, we do not deem it necessary to enter into a controversy with him on the subject, further than to state that Mr. Jones was not present at the tests referred to, and therefore could have no knowledge of the same; and that the writer did not state to Mr. Jones nor to any other person that the water wheels were developing an efficiency of 80 per cent. On the contrary, we have all along maintained that they were very far below their guarantees and have repeatedly challenged the water wheel company to make further tests if it so desired, and demonstrate the efficiency of the water wheels, all of which it has declined to do.

Colorado Springs, Col. G. A. Taff,
Manager The Pike's Peak Hydro-Electric Company.

Measurement of Induction Motor Slip.

To the Editors of Electrical World:

Sirs:—I read with much interest Mr. T. L. Smith's note on the measurement of induction motor slips in your issue of July 7 and can indorse the usefulness of this method from my own experience in a case where all other speed measurements proved to be unreliable. The "retardation" test for determining the bearing friction and the iron losses of motors, one of the most elegant and exact methods of its kind, is practically rendered useless by the additional and uncontrollable friction losses of the counter or tachometer employed, if carried out on small motors. In such a case some time ago the writer used the same method which Mr. Smith discusses for determining the bearing friction of small induction motors. After cutting off the current supply of the motor, stationary stroboscopic effects on the sector disk could be plainly noticed as ⅔, ½, ⅓, ¼, ⅕ of synchronous speed and the time elapsed between the beginning of the retardation and these effects could easily and accurately be observed. These points, in connection with the total retardation time, are sufficient to plot the speed-time or retardation curve whose sub-normal is proportional to the loss of that speed.

Jamaica Plain, Mass. Frederick E. Meurer.

The Simplon Electric Locomotives.

To the Editors of Electrical World:

Sirs:—Various daily and technical publications have published statements with reference to the breaking down of two electric locomotives on the Simplon tunnel. These statements have been made so misleading and may be so hurtful to our interests as American representatives of the Ganz Railway System, that we would feel very much obliged if you would help us correct the same by publishing the following statement.

You are probably aware that, when the Swiss Government decided to use electricity as motive power for the Simplon tunnel, it provided for five electric locomotives. Three of these were loaned by the Italian State Railways, and these three were built by Ganz & Co. and had been in operation on the Valtellina Railway. The other two locomotives were built in Switzerland on an order received originally from the Adriatic Railway for operation on the Valtellina Railway. This order was, however, cancelled later on, due principally to late delivery, and the manufacturers then proposed to use the same for the working of the Simplon tunnel. The electric operation in the Simplon tunnel was commenced on June 1, 1906. From that day on the three electric locomotives built by Ganz & Co. have been continuously in service without any trouble and they are conveying eight trains per day through the tunnel. The two locomotives supplied by the Swiss firm, however, became unfit for service on the first day of operation, as the motors broke down and the equipment had to be sent to the repair sheds. For that reason there are not sufficient locomotives available now for working the traffic exclusively by electricity as motive power, and part of the trains will be conveyed by steam locomotives until the other two locomotives are repaired and made fit for service again.

In view of the great difference in behavior of the two types of locomotives it might be interesting to your readers to know that the motors of the Ganz system have their electrical windings hermetically sealed in metal tubes protecting them not alone against dust and similar substances, but also against moisture and even directly against water. That this protection is most effective seems to be clearly shown by the experience of these locomotives under the trying conditions of the Simplon tunnel. As a matter of fact, the Ganz three-phase equipments are probably the most robust electric locomotives ever built.

New York, N. Y. G. Leve,
Second Vice-President Railway Electric Power Co.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Alternators.—Simons.—It is well known that the total number of lines of magnetic flux in an alternator does not remain constant during one revolution if the pole arc does not cover equal numbers of slots and teeth, and that the total number of lines of flux changes the more the less the number of slots. This results in a higher harmonic of a frequency corresponding to the number of teeth. The author shows that in any case even if the total number of lines of force remains constant higher harmonics are produced on account of the slots in the armature. This is explained with the aid of diagrams.—*Elek. Zeit.*, July 5.

Power.

Direct-Current Power Transmission.—Rouge.—A concise comparison of the relative advantages of the direct-current series Thury system and of the polyphase system for power transmission. Power being the product of voltage and current, the essential difference is that in the Thury system the current is held constant, while the voltage is changed according to the conditions of the load; on the other hand, in polyphase transmission the voltage is held constant and the current changes according to the load. The great advantage of the Thury system lies in the construction of the transmission lines from one point to a distant point. The transmission line is of the simplest form which can be imagined, since there are only two wires required, and in the case of emergency the earth may be substituted for one of them as was found in tests at the Lausanne transmission system. With respect to maximum voltage the stress on the insulators is less than in any other system. There are no dangerous overvoltages due to resonance of higher harmonics or due to opening or closing switches. The dielectrics are not submitted to an interior power loss due to periodic polarization (hysteresis, etc.). On the other hand the Thury system offers difficulties in distribution over areas since it is based in principle on a series connection of the generators and motors, etc., all of which must be connected along one long loop in series. There is, therefore, some difficulty in supplying an area with electric current. The power which may be used on a line is not only limited by the

capacity of the generating station, but also by the insulating resistance of the installation so far made. This complicates any addition of a new consumer to the line. The difficulty of supplying an area may be overcome by using a distribution along circles or rays as shown in Fig. 1 where during hours of light

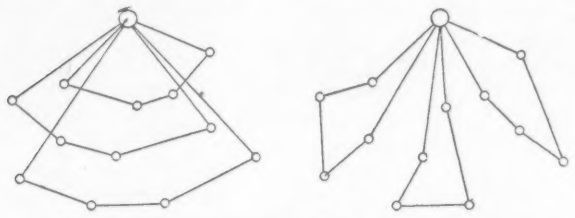


FIG. 1.—POWER DISTRIBUTION ALONG "CIRCLES OR RAYS."

load all the loops may be connected in series to the same generator, while at full load each loop may be connected to its own generator. The author then compares in detail generators and transformers or converters required with both systems. The chief trouble with the Thury system appears to lie in the cost of the necessary converting sub-stations. The author thinks, however, that it is a pity that electrical engineers have paid almost exclusive attention to alternating-current transmission and have left the development of the direct-current series system to one firm and one engineer.—*La Revue Elec.*, April 30.

Machine Mining.—MAVOR.—A paper read before the British Institution of Mining Engineers on practical problems of machine mining. In speaking of electrically-driven coal cutters the author makes the following remarks: It is claimed that the bar type has special advantages in respect to electric driving, in that (1) the rate of rotation of the tool holder more nearly corresponds to the speed of the electric motor than in other types in which the lineal velocity of the cutting tools is similar, but the larger diameter and slower rate of rotation of the tool holder requires a higher ratio of gear reduction; (2) owing to the comparative absence of friction of the tool holder in the cut, the consumption of power is lower and more uniform than in other types; and (3) the freedom of the bar from liability to jam relieves the motor of the excessive strains and periods of overload, to which other types are subject. This last characteristic, which endows the bar machine with its well-known immunity from breakdown of its electrical parts, places it in a pre-eminent position when the system of supply is two-phase or three-phase alternating current. Where the system of supply is open to choice, direct current will be found to fulfill every requirement, and it is free from disadvantages which are inherent to the alternating-current system when used on a small scale. For plant of large size the three-phase system has much to recommend it. So far as liability to ignite gas is concerned, there is nothing to choose between a direct-current motor and an alternating-current motor with slip rings; such liability as exists in the switch box is also common to both types. Even with equal temperature and pressure gas will, if present in the atmosphere surrounding the motor, gain access to its interior by diffusion, if sufficient time is allowed. It is, therefore, desirable, after a coal cutter has been standing for some hours in a situation where there is the slightest reason to suspect accumulation of gas, that it and its switch box be opened and swept out with fresh air. The alternating-current squirrel-cage motor, with the switch submerged in oil, affords the greatest security. The use of oil in coal cutter switch boxes should, however, be avoided if possible.—Lond. *Elec.*, June 22.

European Power Transmission.—The first part of an illustrated description of the Gromo-Nembro transmission system in Italy utilizing the water power of the Serio River. The interesting feature about this plant is that it is the first European power transmission at 40,000 volts, although the length of the transmission line installed at present is only 32 km.—*Elek. Anz.*, June 30.

Electricity in Mines.—Another illustrated note on the International Colliery exhibition in London giving descriptions of switch boxes, electric coal cutters, enclosed switches and fuses, etc.—Lond. *Elec.*, January 29.

Traction.

Supervision of the Earth Currents of Street Railways.—KOHLRAUSCH.—The best and safest means of eliminating stray currents from street railways and their dangers within proper limits consist at present in the following arrangement: To each overhead feeder there should be installed at the feeding point a corresponding rail return feeder. The feeding districts of each cable should not be too large. The mean voltage losses of all return feeders should be made as nearly equal as possible. All feeders and the central station should be well insulated from the earth. If the mean voltage losses of all return feeders are equal, all rail feeding points are on the average of the same potential, and no current passes from one feeding district to another. It is, therefore, most important to make the mean voltage losses of all return feeders equal. Three methods for this purpose are described. One of them which has been used in Hanover consists in placing ammeters in both the feeders and the return feeders and to take readings every 10 or 20 seconds (which was done in this case photographically) and then to compare the current passing through the overhead feeder with the current passing through the return feeder. The two currents should be equal. If they are not, resistances in the return feeder should be adjusted accordingly. This method, however, is complicated and not very reliable. The author advocates the following method: The overhead feeder as well as the return cable of each local feeding circuit are passed in the central station through one and the same differential meter which is then required to show zero current. If it shows that the current fed from the station to the feeding district is greater or smaller than the return current, the adjustable resistance in the return feeder is changed. For such resistances the author recommends simple manganese strips running side by side with sliding contacts.—*Elek. Zeit.*, June 21.

Testing Insulators on Trolley Systems.—A description of a method recently invented by a British firm in connection with A. H. Pott to facilitate the testing of line insulators. The principles involved in the test are that, if an ear insulator is faulty, a current will be indicated on connecting the span wire through a detector to earth, and if a strain insulator is faulty there will be an indication on putting the line pressure through a detector

FIG. 2.—TESTING INSULATORS.

to the span wire. The necessary connections for such a test are made by an attachment shown in Fig. 2. A light aluminum frame is clamped to the end of the trolley boom and carries a wooden cross arm pivoted at its center, so arranged that it always remains at right angles to the trolley wire. At each end of this bar is a light steel spring of special shape, which makes momentary contact with each span wire as the car travels along the route. These contacts, which can be lowered immediately when necessary, are connected up to a detector consisting of a special moving coil instrument provided with a scale reading from 0 to 600 volts, and with a direct-reading insulation scale up to 10 megohms. The usual speed at which a car is run during a test is 7 miles per hour, but the speed may be increased if desired, and thus a test of this kind becomes comparatively simple. —Lond. *Elec.*, July 6.

Self-Induction Effects in Steel Rails.—WILSON.—The author has formerly shown to what extent the resistance opposed to an alternate current by a 70-lb. bull-headed steel rail is increased at ordinary frequencies over the value it would have with direct current. The self-induction effects then studied have since received further attention. A simple calculation shows that the equivalent depth of penetration at ordinary frequencies is only of the order 0.2 centimeter, so that the amperes per centimeter of perimeter is a fair criterion as to the relative merits of differ-

ent sections. It was suggested that a bridge rail would offer a less resistance to alternate currents of given frequency and magnitude on account of its greater perimeter. From the following table it will be seen that the flat-bottomed and bridge rails are superior to the bull-headed rail for a given weight per year. It is interesting to note how greatly superior are the channel and tramway rail sections.

	Perimeter in Centimetres.				
Weight in Lb. Per Yard.	Bull-Headed Railway Rails.	Flat-Bottomed Railway Rails.	Bridge Rails.	Tramway Girder Section.	Channel.
60	40	48.5	49.0	72.0	73.5
70	42	52.5	51.0	76.0	78.0
80	44	56.0	53.0	79.5	82.5
90	46	60.0	55.0	83.0	87.0
100	48	63.5	57.5	87.0	92.0
100	50	67.0	59.5	91.0	96.0

The figures are mean values taken after plotting the curves.—Lond. *Elec.*, July 6.

Electric Traction in Great Britain.—A table giving statistical data on 157 electric tramway systems in the United Kingdom and 16 electrical railway systems. The same table also contains data on 18 electric power companies in Great Britain.—*Sup.* Lond. *Elec. Rev.*, June 29.

Electric Railway Engineering.—Wynne.—In a continuation of this serial the effects of changes in operating conditions are discussed, the author dealing with acceleration, length of running, length of stopping, breaking rates, line voltage and gear ratio. The article is fully illustrated by diagrams.—*Elec. Jour.*, July.

Automobile Omnibuses.—Meyer.—With reference to a recent article of Manville the author discusses the possibility of electric automobile omnibuses in competition with tramways under certain local conditions.—*Elek. Zeit.*, July 5.

Wires, Wiring and Conduits.

Standardization of Rubber Mixtures.—Munro.—An article referring to the recent American Institute paper of Langan. The author says that if there were various standard rubber mixtures, engineers could select, and buyers would pay for, with confidence, the cables deemed most suitable for any particular duty or situation. Such provisions, together with the British standards of radial thickness and tests, would be of great advantage to the electrical industry. Meantime it is well known that for rubber cables nothing is so durable and satisfactory as fine para rubber. For the present the ordinary buyer of rubber cable had best rely chiefly first on the insulation test, second the elasticity test, and third on the good reputation of certain manufacturers.—Lond. *Elec. Rev.*, June 15.

Electrophysics and Magnetism.

Electronic Theory.—Righi.—A paper on some known experimental facts, discussed from the point of view of the electronic theory. Among the subjects dealt with are the influence of the electric density of the electrodes on the discharge; luminous discharges in liquids; sparks in a transversal electric field; photo-electric phenomena; distribution of the potential in discharge tubes; the propagation of electricity in a gas between parallel plates the distance of which is varied and others.—*L'Eclairage Elec.*, July 7.

Electrochemistry and Batteries.

Electric Laboratory Furnaces.—Tucker and Watts.—Two illustrated articles on electric furnaces for laboratory work. Tucker describes several types of vertical arc furnaces for laboratory work, the principal object being to avoid some disadvantages of the Moissan furnace. Watts describes a resistance furnace for heating crucibles which was primarily designed for smelting pure electrolytic iron. A special feature of the design is that the graphite crucible is embedded in a granulated carbon resistor. The furnace is suitable for melting iron and many alloys without danger of absorbing carbon.—*Electrochem. and Met. Ind.*, July.

Electric Smelting of Iron Ore.—A long illustrated abstract of the official report of Haanel to the Canadian Government on the experiments made by Heroult at Sault Ste. Marie. Details are given of various furnace runs, with analysis of the raw materials and the products. As the result of these experiments it is stated that one ton of 2,000 lb. of pig iron produced requires 83 hp-days. This refers to a well-constructed electric furnace in which, however, no attempt is made to oxidize the carbon monoxide of the "waste gases" to dioxide. If this complete oxidation is attempted Heroult estimates theoretically that one ton of iron would require 38 hp-days. This is the lower theoretical limit of energy consumption. An estimate is given of a 10,000-hp plant. —*Electrochem. and Met. Ind.*, July.

Electrotypes.—Cowper-Coles.—In a continuation of his serial for rapid methods for producing electrotypes the author discusses the methods of circulating and agitating the electrolyte and of moving the electrodes.—Lond. *Elec. Rev.*, July 6.

Rotating Electrode.—Perkin.—A Faraday Society paper on a single form of rotating electrode for electrochemical analysis. —Lond. *Elec.*, June 15.

Units, Measurements and Instruments.

Magnet Design.—Howard.—In designing electromagnets for different conditions it is often necessary to change the size of the wire with which a given electromagnet has been wound and to know the voltage which would be required to give the same number of ampere-turns with the new winding. The reverse conditions are also often encountered. The chart designed by the author and shown in Fig. 3, gives a quick and convenient means of obtaining the size of wire, or voltage, in either of the above cases. The principle is as follows: If an electromagnet has one turn of wire of a given size and a certain voltage is applied, the ampere-turns will be equal numerically to the number of amperes flowing or the applied voltage divided by the resistance of the wire. If the number of turns is varied, keeping the mean length of turn and voltage constant, the resistance of the winding will increase, and the amperes decrease in proportion to the number of turns. Consequently the ampere-turns will remain constant. If we substitute for the one turn first taken, one turn of another size then in order to get the same number of amperes flowing, and hence the same ampere-turns, we must vary the voltage in direct proportion to the ratio of the resistance per unit length of the two sizes, or what is the equivalent, in the inverse ratio of their areas as expressed in circular mils. The chart of the author is designed primarily to obtain this ratio. It is divided vertically by lines corresponding to the divisions of the ordinary slide rule, i. e. the numbers on the lowest horizontal line are located at distances from the left hand end of the scale corresponding to the mantissæ of their logarithms. Just above the horizontal line, *C. M.*, are numbers representing the B. & S. sizes from 10 to 29 inclusive, placed opposite the sequence of figures, as read on the lowest line, which express their area in circular mils. The figures below the line, *C. M.*, are the characteristics of the logarithms of the circular mils of the sizes opposite which they stand. In a similar manner are plotted the theoretical ohms per cubic inch for single cotton, single silk, and double cotton covered wires for the B. & S. sizes most commonly used, five-mil insulation being assumed for the single cotton, two mils for sizes 24 to 31 inclusive, and one and three-fourths mils for sizes 32 to 36 inclusive for the single silk, ten mils for sizes 10 to 12 inclusive and nine mils for sizes 13 to 32 inclusive for the double cotton. About one per cent allowance is made for over-size. Several numerical examples of the application of the chart are given; for instance, a magnet may be

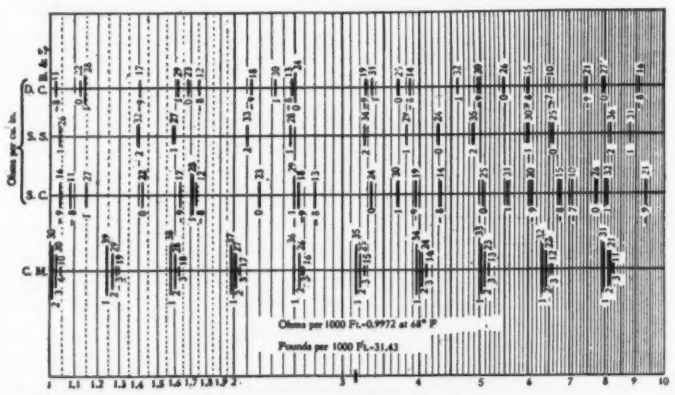


FIG. 3.—CHART FOR MAGNET DESIGN.

wound with No. 12 B. & S. wire and operate on 112 volts, and the problem may be to find the voltage required if the magnet is wound with No. 25. On the line, *C. M.*, measure the distance between figures 12 and 25 and lay off this distance on the lowest line. This gives 20.4 as the ratio of the voltage required to given voltage. Or lay the same distance off to the right of 112, which gives directly 2,280 as the required voltage. The difference between the characteristics opposite 25 and 12 added to the characteristic of the logarithm of 112 determines the number of figures to the left of the decimal point.—*Elec. Jour.*, July.

Greenwich Observatory.—An editorial on the troubles due to the "unfortunate chance that placed the site of the new power station of the London County Council upon the meridian of Greenwich." The disturbances experienced at the observatory are briefly discussed. It is thought to be "absurd to talk lightly of the removal of the observatory" or the partial discontinuance of its observations and "equally irrational is the demand for the abandonment of the generating station upon which such an immense amount of public money has already been spent." A compromise must be found.—Lond. *Elec.*, June 29.

National Physical Laboratory.—A note on the opening of the new electrical laboratory of the British National Physical Laboratory. The new laboratory is devoted to electrical engineering and photometric work.—Lond. *Elec.*, June 29.

Telegraphy, Telephony and Signals.

Directive Antennae.—FLEMING.—A Royal Society paper on the theory of directive antennae or unsymmetrical Hertzian oscillators such as used by Marconi in his method of sending wireless telegrams in a certain direction. The present author shows that the properties of antennae which have part of their length vertical and part horizontal can be deduced from accepted theoretical principles and that the experimental results so far obtained are in general accordance with the theory. His analytical discussion of the operation of a bent oscillator shows clearly that its unsymmetrical radiation in the equatorial plane depends not upon absolute wave-length, but upon the ratio of wave-length to the distance of the receiving point and upon the proportion between the length of the vertical and of the horizontal portions of the oscillator.—Lond. *Elec.* July 6.

Telephony.—WOODBURY.—A paper read before the Engineers' Club of Philadelphia on the telephone system of to-day. The author gives a complete review of present practice.—*Proc. Eng. Club of Phila.*, April.

Cables.—PICOU.—A long mathematical article on the calculation of the capacity and the heating of underground cables. The subject appears to be covered pretty fully and the article contains numerous formulas and diagrams useful for practical applications.—*L'Ind. Elec.*, June 10 and 25.

Cable.—VANONI.—The conclusion of his description of the telegraph and telephone cables of the Simplon.—*Jour. Telegraphique*, June 25.

Miscellaneous.

Association of German Engineers.—The conclusion of the report of papers read at the convention celebrating the fiftieth anniversary of the Society of German Engineers. Prof. Riedler spoke on the development and importance of the steam turbine, Prof. Muthmann on the fixation of atmospheric nitrogen, Dr. Hoffman on power in mines and metallurgical works pointing out the enormous progress made in the use of the electric motor in recent years in such establishments and referring to developments in gas engine construction, gas producers and the utilization of the blast furnace gases. There was some discussion whether the Association should take up the discussion of economical and social questions. The convention voted in the affirmative.—*Elek. Anz.*, June 24.

Exhibits.—In the concluding portion of the report of the recent convention of the German Association of Electrical Engineers exhibits of a number of electrical novelties are mentioned, among which are the new osram lamp which is a modification of the osmium lamp, having a higher efficiency and operated at higher voltages. Further there was exhibited a direct-current motor at 110 volts and 4.65 amperes, built by C. W. Schmidt, the efficiency being 71 per cent, the wires of the magnet coils being not insulated with cotton but simply covered with a layer of enamel and impregnated with paint. There were a great many other exhibits by other German manufacturers.—*Elek. Anz.*, June 10.

Blasting Apparatus.—MAURICE.—A continuation of his serial on electric blasting apparatus with special reference to its use in coal mines. In the present installment the author deals with blasting in shafts and tunnels and blasting in coal mines.—Lond. *Elec.*, July 6

BOOK REVIEWS.

ELECTRICAL NATURE OF MATTER AND RADIOACTIVITY.. By Harry C. Jones. New York: D. Van Nostrand Company. 212 pages. Price, $2.00.

It is only a few years since radium was discovered, and already the literature of the subject is very extensive. It exists for the most part in a very scattered state diffused through scientific journals and other kinds of unpopular literature. Professor Jones has given us a welcome advantage by collecting and collating a large amount of this material into a single volume of reasonable size. The subject is handled, moreover, in an attractively simple way, so that the book is most agreeable reading without loss of accuracy in statement. The description employs very little algebra, but the salient quantitative facts are presented numerically. We can heartily recommend the book to all students of ions and radioactivity.

PRACTICAL TALKS ON ELECTRICITY. By William Baxter, Jr. Chicago: *The Engineer* Publishing Company. 362 pages, 233 Illustrations. Price, $2.50.

This book combines two volumes in one and is divided as follows: Part I.—Principles and Construction of Dynamos and Switchboards. Part II.—Care and Management of Dynamos and Motors. The author treats the subjects in a conversational manner for the benefit of beginners and for engineers and others who wish to obtain some notion of electricity and its applications. Beginning with the nature of electricity and magnetism, he carries the student through a description of electromagnetic fields, commutation, types of dynamos, design of armatures, causes of sparking, various ways of connecting generators, design and construction of switches and switchboards; also the design and operation of switchboard instruments.

Part II contains instructions for using the galvanometer, and the general care of electrical machinery, including the operation of generators in parallel, with reasons for each step in the process. Testing of machines and circuits for grounds and short-circuits, forms an interesting feature. The location and repairing of faults in armatures receives some attention. Details of the construction and operation of different motors, also various forms of connections used with them, and the auxiliaries necessary for their operation, are given and explained. Testing of dynamos and motors for efficiency and the determination of the various losses inseparable from their operation, are considered, and the subject, Storage Batteries and Their Connections, concludes the work. To the working engineer without opportunity to pursue systematically the study of electrical apparatus, this book should prove useful.

THE LETTER OF PETRUS PEREGRINUS ON THE MAGNET, A. D. 1269. Translated by Brother Arnold, M.Sc., Principal of La Salle Institute, Troy. With Introductory Notice by Brother Potamian, D.Sc., Professor of Physics in Manhattan College, New York. New York: McGraw Publishing Company. 60 pages, 4 figures. Price, $1.50.

This is the first great work written in any language on the magnet. Previous writers—Thales, Lucretius, Pliny, Claudian, St. Augustine—refer indeed to the lodestone, but only to describe some experiments and a few mythical feats in illustration of its attractive property, while in this letter we have a complete, systematic treatment of the phenomena and philosophy of the lodestone. The author was one Pierre de Maricourt, a

Frenchman, who seems to have received the best instruction available at the time, probably in the University of Paris, then at the height of its mediæval fame. He was well known to Friar Bacon, who speaks of him as an accomplished mathematician, and one well skilled in matters celestial and terrestrial. He was of a practical turn of mind and seems to have been somewhat of a restless, roving disposition. He went to the Holy Land, probably with one of the crusading expeditions of the age, whence his surname of *Peregrinus* or Pilgrim, by which he is known.

The time in which he interests us most is the year 1269, when we find him away from home with the army of Charles of Anjou besieging the revolted city of Lucera in southern Italy. His resourcefulness and tactical ability were evidently appreciated, for we find him serving in what we would now call the Engineering Corps of the army. Here in the very trenches in front of the beleagured city he found time to work out a problem that evidently had engaged his attention for some time, viz.: to devise a piece of mechanism that would keep an astronomical sphere in continuous rotation. The solution seems to have satisfied him as it appeared on paper; it was a perpetual-motion machine in which magnetic attraction supplied the power, nothing less, indeed, than a *magnetic motor*, the first of its kind of which we have any record. Wishing to inform a friend at home of his success, he wrote out a full account of the mechanism; and, that his Picard friend might the more easily understand the motor and the function of its various parts, he proceeds to describe in a simple, methodical manner, the properties of the lodestone, most of which he himself appears to have discovered. The thirteen chapters into which the work is divided make marvelous reading even to-day by the thorough and comprehensive knowledge of magnetic phenomena possessed by this thirteenth-century magnetizer.

The letter of Peregrinus was written in Latin, as was the custom of the time, and is dated in the camp before Lucera, August 8, 1269. The first complete translation ever given to the world was made four years ago by Prof. Silvanus P. Thompson, of London, and was unfortunately limited to 250 copies. The American translation was made from the first printed edition, of the *Epistola*, Augsburg, 1558, a copy of which is in the Wheeler gift of the Library of the American Institute of Electrical Engineers. A comparison with this, the original, shows the care and fidelity with which the present translation was made. The work is remarkable also for its literary excellence. The beauty of the English is a delight to the reader, and the scholarly introduction by Brother Potamian (Dr. M. F. O'Reilly) is in itself a noteworthy contribution to the history of magnetics. The dress of the book is appropriate to its character, being an edition *de luxe* in printing, paper and binding. In particular, the type page, through a happy selection of type and spacing, recalls the work of the great printers of the past in which artistic effect was attained without recourse to "artistic" fonts and florid embellishment.

Pike's Peak Hydro-Electric Plant.

The following communication has been received from the Abner Doble Company, San Francisco, Cal.:

In your issue of May 26 you comment editorially on the Pike's Peak hydro-electric power plant. There are a few statements in your editorial, concerning which, we, as engineers, would like to take exception.

The Pike's Peak plant employs the highest head attempted in this country, but is surpassed in this regard by the hydro-electric plant installed at Vouvry, Switzerland, some four years ago. The Vouvry installation utilizes a head of 3,200 ft. and is still in operation.

As to the efficiency of water wheels operating under high heads, we agree that there is little authentic data on the subject, but would take issue with you on the point that such tests as have been made, point to increased losses. It has been our experience as hydraulic engineers, during the last 10 or 12 years and covering the period which has witnessed the greatest development in the tangential water wheel, that there is no apparent loss of water wheel efficiency with the increase in head. Our experience is borne out by independent and impartial tests conducted on tangential wheels operating under heads varying from 130 ft. to 1,920 ft. In all of these tests the full load efficiencies were above 80 per cent, averaging over 83 per cent, with a maximum of 84.5 per cent.

As an interesting example of a high head plant, approximating very nearly the pressure on the Pike's Peak plant, we take pleasure in referring you to the Mill Creek No. 3 station of the Edison Electric Company of Los Angeles. This station was placed in operation in April, 1903, the effective head being 1,917 ft. Shortly after the installation of the first unit a test was made on the Doble water wheel by L. M. Hoskins, C. E., Professor of Applied Mechanics at Leland Stanford, Jr., University, assisted by Wm. H. Sanders, M. Am. Soc. C. E., Consulting Engineer U. S. Reclamation Service. In order to obtain authentic results of the operation of the three Doble wheels after two years' service a second test was conducted in June, 1905, by Prof. L. M. Hoskins, assisted by Messrs. F. E. Trask, M. Am. Soc. C. E., Consulting Civil and Hydraulic Engineer, and C. A. Copeland, M. Am. Inst. E. E., Consulting Electrical Engineer of Los Angeles. In response to our request Prof. Hoskins has kindly given us a summary of these tests, which we are pleased to enclose herewith. The statement speaks for itself.

These three units of 750 kilowatts rated capacity each, the same rated capacity as the Pike's Peak units, and practically the same head and speed, have been in successful operation for over three years, running for weeks at a time without stopping, and frequently on 50 to 75 per cent overloads—all this with a full-load wheel efficiency of over 80 per cent and with even a combined water wheel and generator efficiency of 80 per cent at three-quarters overload on the generator. This record, coupled with the fact that on the three wheels, not a single bucket has been replaced since the units were first assembled, we believe, sufficiently demonstrates our statement made above that there is no apparent loss of efficiency with the increase of head and that water wheels can be and have been built which will operate efficiently and with low maintenance expense under extremely high heads.

We have made estimates and stand ready at any time to construct tangential water wheels for operation under heads up to 3,000 feet or even more and to guarantee an efficiency of 80 per cent at full load under such heads.

Following is the communication from Prof. Hoskins referred to above:

"Abner Doble Company, San Francisco Cal.

"Gentlemen.—In response to your request, I give herewith a statement of the general results of the efficiency tests made for you in June, 1905, at Mill Creek No. 3 power station of the Edison Electric Company. These results are abstracted from the fuller report adready submitted to you.

"In regard to these tests I may say that every effort was made to get as reliable results as possible, and it is believed that the conditions, instruments and methods of observation were favorable for much better work than is often possible in tests of water wheels in commercial operation.

"The water was measured by well-constructed steel-plate weirs, the adjustments and hook-gauge readings being made by F. E. Trask, C. E., and myself. The actual fall was determined by leveling, and from this the effective head during each run was obtained by deducting the loss corresponding to the actual discharge. The estimate of this loss was based upon pressure gauge readings made not only under static conditions and during the test runs, but at other times when much greater discharge occurred. The estimate was also checked by computation of the loss of head by the usual rules, and the uncertainty in the results adopted cannot amount to one-fourth of one per cent of the total fall. The actual value of the static head was 1,917 ft., and the estimated loss at full load about 10 ft.

"The power output was measured electrically, the only available method in this, as in most similar tests of commercial plants, but it is believed that the instruments used were such as to secure the highest possible degree of reliability in this part of the test. Two 2,000-ampere, 150-volt, oil immersed wattmeters, of Weston make, were supplied by the Edison Electric

Company. These were used with 7 to 1 potential transformers (the voltage of the generators being 750), and were connected in the usual manner for correctly indicating the power in a three-phase circuit. The electrical side of the test was in charge of C. A. Copeland, electrical engineer, and the readings were made by him and Mr. Wood, who was in charge of the wattmeters for the Edison Electric Company.

"Test runs were made upon each of the three Doble units, the load during each run being held as nearly constant as practicable until steady conditions existed at the weirs, and in most runs readings were continued for about twenty minutes after becoming steady. It was planned to get runs on each unit at 25, 50, 75, 100 and 125 per cent of full load, and the actual runs, in most cases, near these points. A single run was made at nearly 75 per cent overload, and on one unit no-load runs were made, both with and without field excitation. The entire series of 23 runs, divided nearly equally among the three units, showed extremely satisfactory regularity, with no appreciable difference between the different units. The appended table of efficiencies, therefore, applies to all. The generator efficiencies, of course, enter into the computation of the water wheel efficiencies given in the table, and for these it has been necessary to accept the efficiency curve furnished by the General Electric Company.

"It should be said that 'full load' as here used has no reference to the capacity of the water-wheels, but means 750 kw electrical output, the rated normal capacity of the generators.

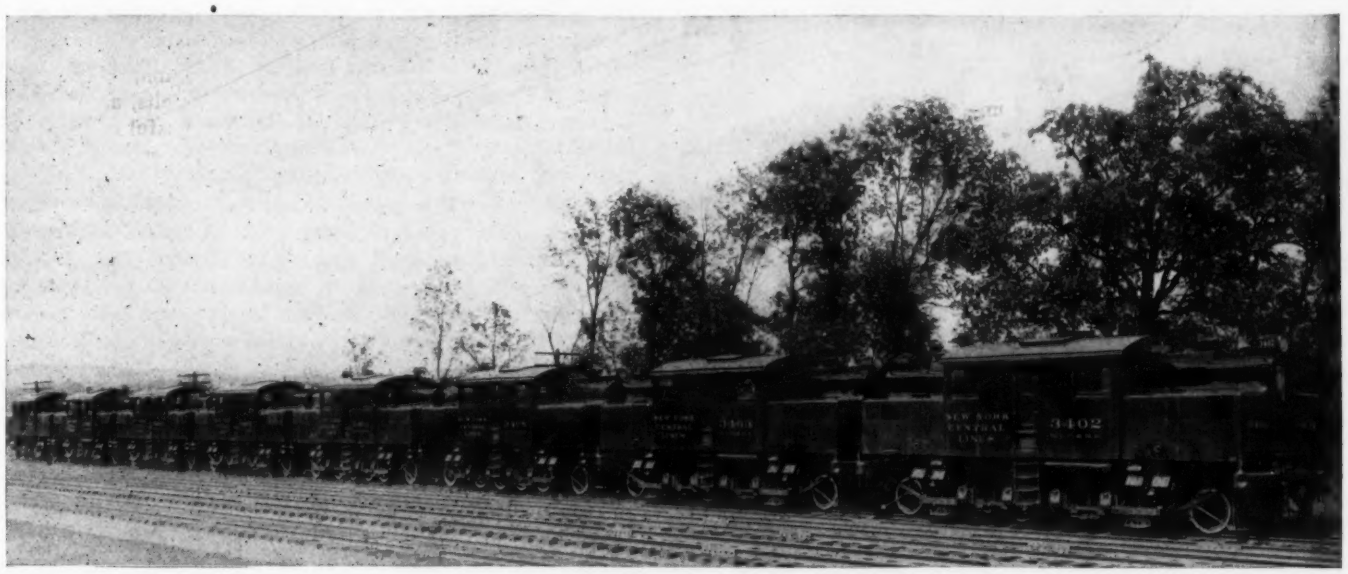
"The series of results showed one feature which was quite unforeseen but very interesting. When each experiment is plotted as a point having for one co-ordinate 'power output' and for the other 'power supplied,' the points lie very close to a straight line; and this is true throughout the entire range from the no-load test to the 75 per cent overload. In other words, equal increments of 'power supplied' give equal increments of 'power output,' the latter being always about 85 per cent of the former. It would appear that the sum of the friction, windage and electrical losses in the combined unit varies comparatively little with the load, and that the hydraulic losses amount to a nearly constant percentage of the power represented by the jet. The hydraulic efficiency seems to be about 85 per cent, irrespective of the nozzle opening.

Fractional Load.	Combined Efficiency.	Generator Efficiency.	Water Wheel Efficiency.
.25	.598	.888	.673
.50	.702	.936	.751
.75	.745	.954	.780
1.00	.768	.962	.798
1.25	.782	.965	.812
1.50	.792	.967	.819
1.75	.800	.968	.826

"A preliminary test was made upon one of these units in April, 1903. At that time it was necessary to depend upon the uncalibrated station watt-meters to measure the output, and the results cannot be regarded as possessing the reliability of the later tests. At 1,000 kw the preliminary test showed an efficiency of the water wheel of 81 per cent, practically identical with the result obtained two years later, while at smaller loads down to about 400 kw the efficiencies obtained were between 80 and 81 per cent, slightly higher than were obtained on the same unit after two years' additional service."

New York Central Locomotives.

Last October the first half of the 50,000-mile endurance run of the first high-speed electric locomotive, No. 6000, built jointly by the General Electric Company and American Locomotive Company, was completed on the test tracks of the New York Central lines in Schenectady. On June 12 this locomotive completed the second half of this exhaustive service test. The maintenance expense per mile for the complete 50,000-mile run amounted to 1.26 cents. This figure includes all maintenance expense on motors, brake shoes, tires, inspection and other miscellaneous items. Moreover, the operating conditions were much more severe than those to which the 35 electric locomotives, which have been ordered, will be subjected. The test locomotive hauled a train averaging from 200 to 400 tons over a six-mile track and high speed running under these conditions involved higher braking and accelerating duty than in regular operating service.



NEW YORK CENTRAL LOCOMOTIVES.

The photograph illustrates eight of the 35 100-ton, 2,200-hp electric locomotives which the manufacturers have built for the New York Central Lines, following the same design as the locomotive No. 6000, which has made such a satisfactory record. There are in all fourteen machines now complete. Of the eight locomotives shown, Nos. 3401 and 3402 have been shipped to New York. The remaining locomotives are well underway at the shops of the General Electric Company and American Locomotive Works, and it is expected that the complete number, 35, will be ready for service in early October.

"Victor" Combination Meter.

The meter shown in the accompanying illustration gives a simultaneous reading of volts, amperes, watts and horse-power on one dial. It is practically two separate and complete instruments combined in one case, each of which acts independently effects of electrically-hauled cars and trains can be ascertained of the other, so far as the volt and ampere readings are concerned. The readings in watts and horse-power are obtained from the point of intersection of the two indicators.

As a wattmeter the instrument is accurate at any voltage within the limits of the volt scale, which is not true of the

ordinary wattmeter, which is only accurate at a pre-determined voltage. The watt scale is laid out from actual calibrations with a reliable standard, insuring absolute accuracy in the result. The horse-power scale is then obtained mathematically from the watt scale.

The instrument has a wide range of uses which will suggest themselves to the practical engineer, and is claimed to be the only

FIG. 1.—COMBINATION METER, FRONT VIEW.

practical switchboard instrument giving a reading in watts and horse-power. While combining four instruments in one, it requires only the space of a single instrument, thus adapting it to the smallest switchboard panels.

In large manufacturing plants, an instrument of this kind will indicate the amount of horse-power chargeable to separate departments or to single units in the same, thus filling a requirement hitherto unsatisfied. The safe working load limit of electrically-driven planers, mill machines, lathes, shapers, etc., can be obtained at a glance, and used as a check on work in a tool. When once the safe load limit is known, the maximum output can be secured by keeping as near to the proper point of intersection of the vertical dial as possible. In mills using electrically-driven squeeze rolls, the pressure between the rolls can be ac-

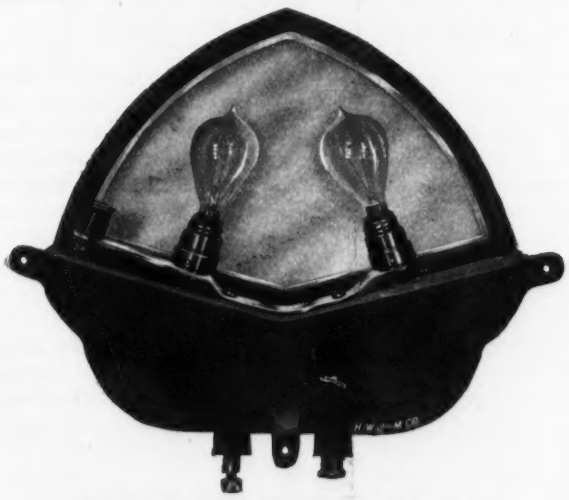


FIG. 2.—COMBINATION METER, BACK VIEW.

curately gauged by noting the horse-power reading and conditions may be duplicated indefinitely.

Applied to electric elevator cars, the operator can weigh each load. When the load limit has been ascertained, any overload can be instantly detected and the excess weight, whether passengers or freight, should be removed. Traction and brake effects of electrically-hauled cars and trains can be ascertained instantly in a way that is positive and thus promote the conservation of power and increase the life of the equipment. To builders of engines, direct-connected generators, electrically-driven printing presses and hundreds of other machines, the facilities afforded by the Victor meter for electrically testing horse-power affords a distinct advantage over the prony brake in first cost, maintenance, reliability and scope.

While the instrument is light in weight, it is very rigid and not at all delicate and will withstand vibrations of considerable violence without its accuracy being impaired in any way. It requires a minimum of energy to operate it, making it extremely sensitive, and it is also free from magnetic lag, unaffected by temperature variations, dead beat and can safely remain continuously in circuit. The instruments are illuminated from the rear (see Fig. 2), thus saving space on the smallest panels. The "Victor" meter is being placed on the market by the H. W. Johns-Manville Co., of New York.

Exhibits at the Contractors' Convention.

Subjoined are notes with regard to the exhibits made at the Cleveland convention last week of the National Electrical Contractors' Association.

The W. J. Barr Electrical Manufacturing Company.—W. J. Barr, of Cleveland, the well-known manufacturer of electric heating apparatus, had an exhibit which attracted a great deal of attention among the contractors and dealers. It included flat-irons for domestic use and for laundries and the various sizes for tailor's and clothing manufacturers; coffee percolators, curling irons, electric stoves, etc. Mr. Thomas E. Barr was in charge and President W. J. Barr and Sales Manager George R. Craven were in frequent attendance.

The Buckeye Electric Company had a large parlor near the entrance to the convention hall. The Buckeye tantalum lamp, which attracted so much attention at Atlantic City, was again in evidence, and was a matter of great interest to the throng of delegates with which the Buckeye headquarters were constantly filled. Mr. L. P. Sawyer, the genial manager of the company, was on hand early and late and was ably assisted in dispensing entertainment by W. Ennes, manager of the Pittsburg office, and Mr. F. W. Bliss, the Cleveland salesman.

Pass & Seymour, Inc., manufacturers of electrical porcelain specialties, had a parlor in which they entertained their many friends. Mr. J. W. Brooks, sales manager; Mr. W. B. Haugh, manager New York office, and Mr. A. M. Little, of the Solvay office, were in attendance throughout the convention and distributed a unique souvenir in the form of a china ash receiver emblazoned with the monogram of the company in colors. While no formal exhibit was attempted, a number of more recent specialties were placed on the table for the inspection of visitors.

Brilliant Tantalums and their able exponent, Mr. E. J. Kulas, were on hand, of course, and it is hard to say which attracted the greater amount of attention. The tantalums were used in illuminating the parlors in which several exhibits were held and which was a popular rendezvous at all times of the day and evening.

The Webb-Gail Manufacturing Company, Buffalo, N. Y., was represented by Mr. Charles W. Webb and Harry M. Gail. It will be remembered that this company manufactures the Universal light holder for incandescent lamps, which, although it has only been on the market a comparatively short time, is meeting with great success.

Mr. E. G. Bernard, of the Troy Electrical Company, Troy, N. Y., made an exhibit of the iron-clad service switches manufactured by this company.

Wagner Electric.—The interests of the Wagner Electric Manufacturing Company were ably cared for by Mr. T. T. Richards, factory manager, and Mr. L. B. Hoyt, Cleveland representative. An exceedingly unique circular in the form of a ticket to Cleveland and return was distributed. The various "conditions" and coupons on this "transportation" explained the advantages of buying Wagner apparatus.

The Crouse-Hinds Co., Syracuse, was represented by A. F. Hills and by F. F. Skell, of the Chicago office, and C. M. Crofoot, of the Cincinnati office. The printed matter which they distributed, including proof pages of their new catalogue, kept Conduletes constantly before the contractors.

MR. N. L. MORRIS, of the Banner Electric Company, took advantage of the trip to Cleveland Wednesday to shake hands with his many friends among contractors and dealers.

MR. H. H. ALBERT and Mr. Crane, of the Standard Electrical Manufacturing Company, Niles, Ohio, were among the lamp people present.

COL. NASH, of the Warren Electric & Specialty Company, spent Wednesday at the convention.

THE ELECTRICAL WORLD had present Mr. G. W. Elliott, of New York and Boston; Mr. C. T. Walker, whose territory includes the district, and Mr. G. S. Davis, the regular Cleveland correspondent.

THE A. & W. ELECTRIC SIGN COMPANY, of Cleveland, showed several novelties in electric sign construction, among them a small individual sign mounted on an artistic bracket for drug stores, cigar stores, etc., and a new interchangeable letter socket. The signs are made up in blocks forming individual letters and the combination of sockets is such that any letter may be set over the sockets and the lamps outlining the letter always register with a suitable number of sockets. This form of sign is very desirable for theatres or for places of business which desire to change frequently. It also enables central stations or contractors to buy a supply of blocks and erect their own signs. The signs are quickly connected by the use of an angle iron frame, the letters being attached by means of clips which are attached to the blocks. H. J. Walser, F. D. Edgar and F. E. Hayes were in attendance at the exhibit at the hotel and interested customers were taken to a more extensive exhibit at the company's factory not far distant.

THE REYNOLDS-DULL COMPANY, of Chicago, was represented by Mr. Dull, who had an exhibit of several varieties of the company's electric sign flashers.

MR. H. B. KIRKLAND, of the American Circular Loom Company, was as usual, much in evidence, and distributed a handy souvenir to the delegates. Other representatives of his company were M. F. King and H. C. Adams, Jr.

AMONG OTHER prominent manufacturers and supply men present were the following: W. C. Marker and L. Gnesser, Cleveland Electrical Supply Company, Cleveland; L. L. Norman, Cleveland Switchboard Manufacturing Company, Cleveland; U. G. Tingley and F. W. Harrington, John A. Roebling's Sons, New York; I. A. Bennet, National Metal Molding Company and Osborn Flexible Conduit Company; J. A. Erner, Erner Electric Company, Cleveland; P. H. Hoover, New York Insulated Wire Company, New York; W. M. Kirkwood, Kirkwood Electric Equipment Company, Niagara Falls; J. M. Tullman, Steel City Electric Company, Pittsburg; C. O. Baker, Westinghouse Company, Cleveland; R. L. Jaynes, Hart Manufacturing Company, Hartford; P. R. Fisher, Conduit Electric Manufacturing Company, Boston; L. A. Somers, Stanley-G. I. Company, Cleveland; F. H. B. Whipple, Sawyer-Mann Company; E. G. Bernard, Troy Electric Company, Troy, N. Y.; Frank W. Eastman, Stanley & Patterson, New York; Elliott Reynolds, Doubleday-Hill Electric Company, Pittsburg; C. E. Corrigan, National Metal Molding Company, New York; Thomas T. Richards, Wagner Electric Manufacturing Company, St. Louis; Arthur O. Einstein, Manhattan Electric Supply Company, New York; C. H. Hadrell, Barret Electric Company, Cincinnati; W. E. Phelps, Phelps Company, Detroit; Walter T. Ambros, Osborn Flexible Conduit Company, Cleveland; Perry R. Boole, Electric Appliance Company, Chicago; J. B. Olson, India Rubber Gutta Percha Insulating Company, New York; Chas. Huth, De Veau Telephone Manufacturing Company; George H. Porter, Electric Appliance Company, Chicago; Chauncy L. Hight, Henry D. Sears Company, Boston; Oscar P. Wodock, Crescent Electric Manufacturing Company, Valparaiso, Ind.; E. W. Rockefellow, Western Electric Company, Chicago; B. F. Bechtel, Mar Manufacturing Company, Chicago; A. M. Little and W. Brewster Hall, Pass & Seymour; Thomas F. Ryan, Ft. Wayne Electric Works, Ft. Wayne, Ind.; J. M. Dusanberry, Western Electric Company, New York; H. S. Green, Chicago, Nungesser Electric Battery Company, Cleveland; Herbert D. Betts, Thomas & Betts Company, New York; Harry H. Hornsby, Sprague Electric Company, New York; Edward S. Ford, Triumph Electric Company, Cleveland; F. B. Fortune, National Metal Molding Company, Pittsburg; Robert Garland, Safety Armorite Conduit Company, Pittsburg; S. B. Condit, Jr., Condit Electric Supply Company, Boston; D. B. Scarborough, Vallee Bros. Electric Company, Philadelphia; Arthur A. Anderson, Standard Underground Cable Company, Pittsburg; M. D. Austin, M. B. Austin Co., Chicago; N. C. Cotabish, sales manager National Carbon Company, Cleveland; Burt Humphreys, Lawton Electric Company, Cincinnati; H. B. Kimbar, Standard Underground Cable Company, New York; E. E. Nash, sales manager Warren Electric Specialty Company, Warren; R. K. Mickey, president Novelty Incandescent Lamp Company, St. Marys, Pa.; Walter S. Bissell, V. O. Gray and Frank Knieren, F. Bissell Company, Toledo; Walter G. Wells, American Electric Novelty Company, New York; F. E. Colwell, Cincinnati, and S. Wolff, Cleveland, Allis-Chalmers Company, Milwaukee; U. S. Armstrong, American Conduit Manufacturing Company, Pittsburg; C. S. McDowell, Cleveland Gas & Electric Fixture Company, Cleveland; W. A. Rowe, Buffalo Forge Company, Buffalo; M. L. Zahn, George Worthington Company, Cleveland; Wm. McMullen, Electric Appliance Company, Cleveland.

An Isolated Plant in Milwaukee.

A new typical isolated plant is that supplied by the Allis-Chalmers Company for the Wells Building Company, of Milwaukee, in the new Stephenson Building, recently erected by it in the center of the Milwaukee East Side retail district. The building as originally planned was to be fifteen stories in height, but owing to subsequent change in plans this structure, which is connected by a service tunnel with the Wells Building only one square away, has been completed for the present to the fourth story only. The structure is built of gray pressed brick, with foundations that rest on bedrock some forty feet below the surface. The power plant, which occupies an entire floor of the basement, consists of engine and boiler rooms, where the equipment of engines and generators is erected on rigid rock foundation. The entire layout as originally specified will comprise six engines, direct-connected to generators having an aggregate capacity of 3,000 kw with a corresponding equipment of boilers, pumps, etc. At the present time the first unit, consisting of a vertical cross-compound engine, direct-connected to a 500-kw, direct-current generator, is already installed and ready for service, while a unit similar to it in all respects will be ready for operation some time during the summer. The other units provided for in the original plant are to follow later, as they are required. The boilers already installed are two Aultman-Taylor Company's caball type, provided with the McKenzie Furnace Company's Dutch ovens, each 500 hp. As fast as new engine and generator units are installed, it is the intention to add similar boiler units for each. The engines will run non-condensing at a speed of 100 r.p.m. The generator in each case is mounted on the engine shaft between the bearings. Each engine will develop 700 indicated hp with a consumption of not to exceed 20 lb. of dry steam per indicated hp per hour. Two eccentrics are provided for each cylinder, one for the steam and one for the exhaust valves. Safety stop valves are provided, placed in the main steam pipe next to the throttle, and under the control of a separate governor so arranged as to trip the safety stop valve and shut off the steam in case the engine runs faster than a fixed limit above normal speed. The generators are engine type machines, 500 kw and 250 volts.

This plant will be operated in parallel with the power plant of the Wells Building for furnishing light, power and heat used in the two buildings. The heating is accomplished through exhaust steam from the engines exclusively. The plant of the older building, in conjunction with which the new units will be used, was installed three years ago in the basement of the first building and consists of three Allis-Chalmers heavy-duty engines, coupled to direct-current generators, these units having an aggregate normal capacity of 800 kw.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Highly satisfactory reports of the crops, trade and industry were made and all were optimistic as to prospects for fall business. So far the July trade exceeds that of a year ago. Building continues active, and reports as to iron and steel generally show larger sales and bookings than were expected. Advices from Chicago report a growing scarcity of pig iron for quick shipment in the Western market. Sales of finished steel are reported well up to the rate of distribution in previous months, and the wholesalers have had no opportunity to accumulate stocks. Specifications are hopefully large, and the activity has extended to all products, including some that were inclined to drag in the market of a month ago. Railway earnings thus far reported for July show an average increase of 7.2 per cent over last year's. Bank exchanges at New York were 11.4 per cent larger than a year ago, while at other leading cities there was an average gain of 12.6 per cent. Bessemer pig iron has advanced 50 cents a ton, the supply being smaller, and additional furnaces are blowing out for repairs. Bessemer billets are up 50 cents, and 5,000 tons have been imported for re-exportation in finished goods, the quotation at the foreign port being about $22.50. New business in steel rails for delivery in 1907 was good, and the principal plant in the Chicago district is booked to October, 1907. Vessel work on the lakes is increasing, which means an enlarged demand for plates, and the Pittsburg mills anticipate early orders for plates and structural material for the two new battleships, the armor contracts for which have been awarded. Structural material is in very good demand, especially for bridge building. It is reported that large orders for cars are pending, and demand for track supplies is active. Copper is lower, general demand being light. Among wire drawers, cable makers and workers in sheet and cast copper and brass new records are being made as to consumption. With top-notch production going on the leading copper and brass mill and foundry owners report that more business can be done as soon as the numerous enlargements of plants now under way can be utilized. As to sales, a steady business is going on for September and November shipments. Prices are firm and unchanged. Electrolytic, 18½ to 18⅝c., September and October shipments; Lake, 18¾ to 18⅞c. Casting grades, 18½ to 18⅝c., thirty days. *Bradstreet's* reports that there were 188 business failures during the week ending July 19, against 143 the week previous, and 165 in the corresponding week last year.

BLAST FURNACE GAS ENGINE PLANT FOR INDIANA STEEL COMPANY.—What will eventually develop into perhaps the largest gas power plant in the world has its inception in an important contract recently placed with the Westinghouse Machine Company, of East Pittsburg, for eight large gas-driven blowing engines to be installed in the steel plant at Gary, Ind. As it is the expressed intention of the United States Steel Corporation, which controls the Indiana Steel Company, to make this the foremost American steel center, the significance of simultaneous development of gas power is obvious. The machines comprised in this initial order will be uniform in size and capacity. Each gas engine, as an electric unit, will have a rated capacity on blast furnace gas of nearly 3,000 hp, corresponding to a rating of 4,000 hp on natural gas. The unit will be arranged in twin tandem fashion, each side consisting of two double-acting gas cylinders and one blowing cylinder in the opposed or "vis-a-vis" arrangement. Power cylinders are 42 in. and the air cylinders 68 in. in diameter with a common stroke of 54 in., the unit running at a maximum speed of 75 r.p.m. for blowing and 84 r.p.m. for electric work. The capacity of air delivery at this speed will be 33,000 cu. ft. of free air per minute at 18 lb. pressure, with a maximum pressure delivery of 30 lb. per sq. in. This type of engine will not only be used for blowing purposes, but also for electrical generation. In all sizes a resemblance to the horizontal tandem heavy-duty steam engine design is strong. The general design conforms quite closely to that of similar machinery ordered by the United States Steel Corporation for the Carnegie Steel Company's plant at Bessemer, near Pittsburg. It also follows closely, bu tupon a larger scale, the design of a number of smaller units already in operation in various parts of the country for power work, notably those at the plants of the Warren & Jamestown Street Railway Company, Warren, Pa.; Standard Steel Car Company, Butler Pa.; Iola Portland Cement Company, Iola, Kan.; Carnegie Technical Schools, Pittsburg, etc. Some of these smaller plants are operating on natural gas, but with the exception of slightly different proportioning of air and gas passages and cylinder diameter, the general construction of the natural gas engine is practically identical with that intended for leaner gases, such as producer and blast furnace gases. For several months a 350-hp engine of this type has been in regular operation on blast furnace gas at the Edgar Thompson Works, Pittsburg, generating electricity for motor-driven foundry machinery. The engine was installed largely for experimental purposes, and has given such excellent operating results that the success of the larger machines may be regarded as an assured fact. This engine is now undergoing a 30-day continuous load and duty test, operating 24 hours per day and seven days per week during the period.

BELL TELEPHONE OUTFIT.—The American Telephone & Telegraph Company's instrument statement for June and six months compares as follows:

Month of June:	1906.	1905.	1904.	1903.
Gross output	217,243	120,555	83,312	87,608
Returned	54,973	52,427	44,144	42,189
Net output	162,270	68,128	39,168	45,419
Jan. 1 to June 30:				
Gross output	1,161,857	897,620	591,684	600,064
Returned	358,335	283,542	247,190	235,141
Net output	803,522	614,078	344,494	364,923
Total outstanding	6,501,780	5,094,642	4,124,011	3,515,243

This represents 3,250,890 sets of instruments and about 3,000,000 subscribers.

A GREAT FOREIGN TRADE.—The Bureau of Statistics, Department of Commerce and Labor, reports imports and exports of merchandise for June and for the year ending June 30, as follows:

June.	1906.	1905.	1904.
Imports	$100,831,607	$90,435,674	$81,157,235
Exports	124,933,995	121,095,274	93,224,866
Excess of exports	$24,102,388	$30,659,600	$12,067,631
Twelve months ending June 30:			
Imports	$1,226,615,379	$1,117,507,500	$991,087,371
Exports	1,743,763,612	1,518,462,833	1,460,827,271
Excess of exports	$517,148,233	$400,955,333	$469,739,900

WORK IN NORTH CAROLINA.—The following is an extract from a letter from Marcellus E. Thornton, president of the Thornton Light & Power Company, Hickory, N. C.: "I am working for the water power development four miles from town on the Catawba River with trolley car lines. I am just negotiating for the financing of both enterprises and have the best people in the business on my line, and expect to have it a go now very soon. We shall get 5,000 hp or over with 30-foot head. I own all the land and rights. The company is ready to be organized just as quick as the other arrangements are completed. We have a charter for 65 years and franchise from city for street cars for 35 years from June 1. There will be, if it proves feasible, nearly 58 miles of street railway. Freight traffic will pay interest on the bonds and dividend. The whole job will require about $1,500,000 of 25 or 30-year five per cent bonds."

AMERICAN-BALL ENGINE ORDERS.—The American Engine Company, of Bound Brook, N. J., the manufacturer of the American-Ball engines and of electric generators and motors, reports among its recent sales the following: Two 80-hp duplex compound engines to the De Lamar Copper Refining Company, Perth Amboy, N. J.; three duplex compound engines to the E. I. Du Pont Company, Wilmington, Del. (making their seventh order for this type); three duplex compound engines to a San Francisco firm; two 200-kw (engine type) generators (to be water-wheel driven) to the W. D. Boyce Paper Mills Company, of Marseilles, Ill.

THE STROMBERG-CARLSON TEL. MFG. CO., Rochester, N. Y., has closed contracts for switchboards in the following places: St. James, Minn.; Stites, Idaho; Palouse, Wash.; Weatherford, Tex.; Seattle, Wash.; Rochester, N. Y.; Syracuse, N. Y.; Minneapolis, Minn.; Carbury, N. D.; Webster, N. Y.; Sodus, N. Y.; Mt. Vernon, Wash.; Eminence, Ky.; Plain City, Ohio; Columbus, Ohio; Caldwell, Idaho; Esmont, Va.; Rome City, Ind.; Delaware, Ohio; Lyndonville, N. Y.

APPARATUS FOR JAPAN.—The Westinghouse Machine Company has furnished a complete gas engine equipment to the University of Tokio in Japan. The same company has also shipped to the Sottsu Cotton Spring Company, at Sottsu, Japan, a power plant for the operation of the machinery.

PRICE OF ALUMINUM.—The price of all grades of aluminum has been advanced one cent per pound by the Pittsburg Reduction Company. A two-cent rise was made in December. A comparison of prices, in cents per pound, showing the relative positions at each change in price, follows:

		Previous to	
	July, '06.	Dec. '05.	Dec. '05.
No. 1, 99 per cent pure ingots	36	35	33
No. 2, over 90 per cent pure ingots	34	33	31
Nos. 11 and 12 casting alloys	36	35	33
Nos. 21 and 22 casting alloys	34	33	31
Nos. 31 and 32 casting alloys	31	30	28

Financial Intelligence.

THE WEEK IN WALL STREET.—What little business was transacted on the Stock Exchange was of a professional character, although there was a rather firm undertone manifest at times. Some satisfaction was felt in regard to the announcements as to the disposition by the Government of the money derived from the sale of the Panama Canal bonds, also from the fact that some $2,500,000 gold was exchanged by New York hands in Europe and Australia and that foreign exchange continues heavy. There were, however, no especially striking incidents or developments. At the close of the week the market was decidedly strong, the list displaying general advances. Among the electric stocks, all show gains on the week's business except Allis-Chalmers, common preferred, which lost ¼ and 1¾, respectively, the closing quotations being 16½ and 45. General Electric advanced 2¾, closing at 163, and Westinghouse 1 point, the last quotation being 153. American Locomotive common closed at 69¾, and preferred at 114½, these being gains of 1¾ and 1¼, respectively. The traction stocks were stronger, Brooklyn Rapid Transit closing at 74¾, a net advance of 2¼, Inter-Metropolitan common at 37¾, a gain of 1½, and preferred at 76¾, an advance of 2¾ points. Western Union closed at the highest point of the week—92—which represents a net gain of ½-point. There were no sales of the following-named stocks and the quotations given are the last recorded: American District Telegraph, 37; American Telegraph & Cable, 92; Central and South American Telegraph, 140; Electric Storage Battery, 84¾; Metropolitan Street Railway, 103⅜; Michigan State Telephone preferred, 92; New York & New Jersey Telephone, 147, and Westinghouse first preferred, 180. The curb market was irregular all the week, but rallied somewhat at the close in sympathy with the Stock Exchange list. There was practically no response from outsiders. Most of the sales represented clique operations. Following are the closing quotations of July 24:

NEW YORK

	July 17	July 24		July 17	July 24
Allis-Chalmers Co.	16	16¾	General Electric	162	164
Allis-Chalmers Co. pfd.	42	47	Hudson River Tel.	...	...
American Dist. Tel.	25	25	Interborough Rap. Tran.	35¾	...
American Locomotive	68¾	69¼	Mackay Cos.	71¼	71¼
American Locomotive pfd.	112	113	Mackay Cos. pfd.	71⅜	71⅜
American Tel. & Cable	90	90	Marconi Tel.	42	...
American Tel. & Tel.	125	128	Metropolitan St. Ry.	...	...
Brooklyn Rapid Transit	73½	74½	N. Y. & N. J. Tel.	...	...
Electric Boat	25	25	Western Union Tel.	91¼	91⅜
Electric Boat pfd	70	70	Westinghouse com.	150	152
Electric Vehicle	10	10	Westinghouse pfd.	...	...
Electric Vehicle pfd.	15	12			

BOSTON

	July 17	July 24		July 17	July 24
American Tel. & Tel.	130¼	131	Mass. Elec. Ry. pfd	69	68
Cumberland Telephone	...	115¼	Mexican Telephone	3⅜	4
Edison Elec. Illum.	240	...	New England Telephone	129¾	131
General Electric	...	165¼	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	19	...	Western Tel. & Tel. pfd.	...	...

PHILADELPHIA

	July 17	July 24		July 17	July 24
American Railways	52⅛	52⅛	Phila. Electric	7⅞	8
Elec. Co. of America	11¾	11	Phila. Rapid Trans.	29¼	30
Elec. Storage Battery	67⅛	68	Phila. Traction	99	99
Elec. Storage Battery pfd.	...	..			

CHICAGO

	July 17	July 24		July 17	July 24
Chicago City Ry.	160	160	National Carbon.	85	84
Chicago Edison	...	...	National Carbon pfd.	118	119
Chicago Subway	43	44	Union Traction	...	...
Chicago Tel. Co.	...	...	Union Traction pfd	...	...
Metropolitan Elev. com.	26	27			

* Asked

THE PHILADELPHIA SUBURBAN ELECTRIC COMPANY, with general offices in the Land Title Building, Philadelphia, has purchased the electric lighting property at Clifton Heights, Pa. The Suburban Company had previously purchased the plants at Morton and Lansdowne and now controls the entire electric lighting and power situation in Delaware County. Plans are being prepared for a new station and as soon as the estimates are in work will begin and pushed forward as rapidly as possible, so as to have the new plant in operation before cold weather. This consolidation gives the Suburban Company the control of all electric lighting between Media and Philadelphia, and Chester and Philadelphia, and it is rumored that it will be strong competitors for the lighting in Chester, and will put the price of current at such a figure as to compete with the gas company in eastern Delaware County.

LARGE TELEPHONE LOAN.—The American Telephone & Telegraph Company is reported from Boston to have borrowed from banks $5,000,000 on notes running from three to six months. It was explained that this borrowing was in anticipation of the receipt of funds, which will be provided by the underwriters of the recent bond issue. Last spring the American Telephone & Telegraph Company sold $100,000,000 of convertible bonds to a syndicate headed by J. P. Morgan & Company and Kuhn, Loeb & Company. It was provided at the time of the sale that payment for the bonds was to be made in installments extending over all of this year and part of next. Two calls of 10 per cent each, yielding $20,000,000, have already been made upon the members of the underwriting syndicate, and another call for 10 per cent is expected to be made in October. The growth of the business is so enormous the company is using up new capital at an unprecedented rate.

LONDON UNDERGROUND.—A call was issued this week to the subscribers to the London Underground syndicate for a third payment of 25 per cent on the company's stock. The amount of the issue is $25,000,000 (£5,000,000) upon which $12,500,000 has already been paid. When this third call is turned in, the company will have received from the proceeds of its sale of stock a total so far of $18,750,000. The proceeds of this third call will be used to carry on the work of construction that has been in progress for some time. Part of the London underground system has been in operation for some time. Several additional sections are expected to be completed in the very near future. It will be a year or more, however, before all the work that has been laid out will be finished.

STONE & WEBSTER COMPANIES.—The various local companies under Stone & Webster management report a healthy state of business for May and for the twelve months, as exhibited in the following summary of gross annual earnings:

	1906.	1905.
Cape Breton Electric Company	$241,104	$196,898
Dallas Electric Corporation	996,462	801,657
El Paso Electric Company	322,533	272,041
Galveston Electric Company	279,642	256,281
Houghton County Electric Company	224,886	196,426
Houston Electric Company	551,997	394,327
Lowell Electric Corporation	267,191	244,101
Minneapolis General Electric	759,369	679,504
Savannah Electric Company	609,734	562,297
Tampa Electric Company	435,923	384,009
Terre Haute Traction & Light Company	692,720	588,558
Whatcom County Railway & Light Company	232,116	167,837

RUTLAND (VT.) CONSOLIDATION.—The interests who purchased the Rutland Railway & Gas Company and the Chittendon Power Company and who consolidated these companies into the Rutland Railway & Power Company, have purchased the Rutland City Electric Company, which is also to be included in the consolidation. Mr. G. Tracy Rogers, of Binghamton, N. Y., has been elected president, and Leo H. Wise, vice-president, of the Electric Light Company. This consolidation will now include all the public service corporations of Rutland.

OYSTER BAY CONSOLIDATION. — The New York State Commission on Gas and Electricity has heard the application of the Nassau Light & Power Company, Long Island, for consent to acquire the stock of the Oyster Bay Electric Light & Power Company.

SALE OF LACOMBE ELECTRIC COMPANY.—The American Light & Traction Company has sold the property of the Lacombe Electric Company, of Denver, which it purchased last January, to the Denver Gas & Electric Company.

CUMBERLAND TELEPHONE.—The Cumberland Telephone & Telegraph Company reports $451,294 gross for June and $2,635,738 for six months. The net for six months was $923,310 and the net after charges, $811,638.

TOLEDO RAILWAYS & LIGHT reports $178,110 gross for June and $962,502 for the six months, the surplus being $199,936. There has been a steady gain all the year.

UNITED STATES TELEPHONE.—Reports have been current in Cleveland that the United States Telephone Company will increase its dividend on its common stock from 3 to 4 per cent beginning with the first of next year. One of the executive officials says in a letter: "Relative to dividends on United States Telephone stock you can give your friends every assurance that these dividends will be continued, and that the dividends declared will be conservative. The business of the United States Telephone Company is not only rapidly increasing, but the company to-day is absolutely unable to handle all the business offered. We are putting up $200,000 of additional copper circuits on pole lines already established, and we expect to put up $200,000 worth of copper wire in addition to this before the end of the year. Our estimate is that this additional money expended will yield net over 15 per cent on the investment the first year, which will largely increase in the second year. Our statements on the United States Telephone are actual and not estimates. Not only are we certain that the 3 per cent dividends will be continued, but we are certain that we will be able to increase the dividend to 4 per cent the first of next year, at the same time carrying over a very large surplus." The gross earnings of all the U. S. properties in 1905 was $4,155,505 and the net before dividend $1,005,836. The common stock outstanding is $12,570,000, the deferred $30,000,000 and the collateral trust bonds $17,000,000. The assets of $88,490,204 include $56,459,343 in stocks, bonds, etc., of the Stromberg-Carlson Telephone Manufacturing Company, Rochester Telephone Company, New York Independent Telephone Company, Utah Independent Telephone Company and the Indianapolis Telephone Company.

AMERICAN LIGHT & TRACTION.—The common stock of American Light & Traction Company was placed on a 5 per cent basis last week by the declaration of a quarterly dividend at the rate of 1¼ per cent, payable August 1. The rate for the common stock has hitherto been 1 per cent quarterly. At the same time the directors declared the regular quarterly dividend of 1½ per cent on the preferred stock, which is also payable Aug. 1. The company reports an increase in net earnings for the six months ending June 30, 1906, of 92.20 per cent over the corresponding period of last year. Since the beginning of the year the company has acquired 97 per cent of the capital stock of the Detroit City Gas Company. This, together with the new properties of the Quebec-Jacques Cartier Electric Company, the Lacombe Electric Company (since sold to the Denver Gas & Electric Company), and the Muskegon Traction & Lighting Company, also purchased by the company subsequent to June 30, 1905, accounts to a great extent for the large increase shown. Calculated on the basis of the old properties only, the net earnings for the six months ending June 30, would show an increase of 25.04 per cent over the same six months of last year. Notwithstanding this increase in net earnings, amounting to $490,954 over last year, only $106,268 was carried to surplus account as against $168,759 on June 30, 1905. This is due to the increased dividends paid this year and to the fact that the directors have started a "Reconstruction Reserve" fund for which they have written off $339,400. In the opinion of the directors this fund has become necessary in view of the possible improvements, which the acquisition of the new properties will call upon the company to make in the near future. The total gross earnings were $1,023,535 and in the corresponding six months of 1905 they were $549,081.

CONSOLIDATION AT LEOMINSTER, MASS.—Plans are being formulated for the consolidation of the Leominster Electric Light & Power Company and the Leominster Gaslight Company, both of Leominster, according to George Rossmann, of Keene, N. H., the treasurer of the Leominster Gaslight Company. Each company has made the other an offer to buy out the other. The matter is to be considered at the early meeting of the directors of the Gaslight Company. The Leominster Gaslight Company is controlled principally by Mr. Rossman and Wallace Mason, both of Keene, N. H. The latter is the president and the former the treasurer. This concern has had control of the gas lighting in Leominster for about four years and up to this year has never paid the stockholders any dividends. According to Mr. Rossman, it is up to the stockholders themselves, as to whether the company shall declare and pay a dividend this year or whether it shall put the surplus profit into improvements. He prefers to see the money go into improvements. The electric lighting system has a paid up capital stock of $50,000.

DIVIDENDS.—The directors of the American Light & Traction Company have declared a dividend of 1½ per cent on the preferred stock and 1¼ per cent on common stock for the quarter ending June 30, payable August 1. This represents an increase of ¼ per cent on the common stock over the last quarter. The directors of the Twin City Rapid Transit Company have declared the regular quarterly dividend of 1¼ per cent on the common stock, payable August 15. The Western Telephone & Telegraph Company has declared a regular semi-annual dividend of 2½ per cent on the preferred. The directors of the Helena Light & Railway Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable July 23. The directors of Amalgamated Copper have declared a quarterly dividend of 1½ per cent and one-quarter of 1 per cent extra. This is the same rate that was paid in the preceding quarter. The dividend is payable August 27.

BELL TELEPHONE OUTPUT.—The prosperity of the American Telephone & Telegraph Company is evidenced by the large output of apparatus, and it is estimated by the *Wall Street Journal* that this growth shows at least 11 per cent earned on the stock this year. The stock outstanding is $131,551,400. The net output of instruments for the first six months of this year was 803,522, a greater amount than in any previous twelve months in the history of the company, with the exception of 1905. The average output for the first six months of each of the past five years has been close to 50 per cent of the entire output for each of those years. On this basis it is conservative to estimate the total net output for 1906 at approximately double the figures for the first six months, or, say, 1,600,000 instruments, which means 800,000 new stations.

CALIFORNIA TELEPHONE.—The Los Angeles *Herald* says that articles of incorporation of the Home Telephone & Telegraph Company, with an authorized capitalization of $10,000,000 stock and $10,000,000 bonds, have been filed in the office of the county clerk. The incorporators are local capitalists. The company has been organized for the purpose of taking over and combining the Home telephone plants in several of the Southern California cities. So far, ten of these outside companies have been absorbed, and it is understood that options on a number of others have been secured. Of the ten companies taken over, five have completed plants in operation.

CHATTANOOGA LIGHTING.—To provide for the enlargement of the plant and the extension of its service the stockholders of the Citizens' Light, Heat & Power Company, of Montgomery, Ala., have organized a corporation under the name of the Citizens' Light & Power Company and have taken stock in exchange for their holdings in the old. The change was made to take advantage of the liberal corporation laws of Alabama. The officers are as before: Alex. Rice, president; E. Meertieff, vice-president; P. R. Whiting, secretary, and J. L. Cobbs, treasurer.

MARYLAND ELECTRIC RAILWAY.—The *Journal of Commerce* states that the new plan for financing the United Railways & Electric Company, of Baltimore, has been approved by the income bondholders' committee. The company is to be supplied with $6,500,000 for the improvement of the plant. For the accrued interest on the income bonds, amounting to $1,400,000, a five per cent 30-year bond will be issued, and bonds of this same issue will be used to pay the semi-annual interest until December 1, 1910, when it is expected that the company can resume cash payments of interest. The new capital is to be furnished by the Maryland Electric Railway Company.

MOHAWK VALLEY TROLLEYS.—The Mohawk Valley Company, of Utica, has increased its capital stock from $10,000,000 to $20,000,000. Of the old stock, the New York Central held $6,000,000 and Horace E. Andrews $4,000,000. The Mohawk Valley Company is the operating company for the trolley properties which the New York Central has acquired in recent years, including the Utica & Mohawk Valley, the Syracuse Rapid Transit Company and the Rochester lines. The Andrews syndicate retains an interest in them and also owns a half-interest in the Schenectady Railway Company.

CONSOLIDATION OF CHICAGO ELEVATED.—The Chicago Elevated Road consolidation has reached a stage, it is stated, involving the formation of a separate holding company with three classes of stock, first and second preferred and common, amounting to about $50,000,000.

MANILA EARNINGS.—The Manila Electric Railway & Light Company shows gross earnings of $73,750 for June and $38,000 net. Of the gross, $43,250 was from the railway and $30,500 from lighting.

GENERAL NEWS.

Construction News.

FORT DEPOSIT, ALA.—Contracts have been let for the construction of the new municipal electric lighting plant and work will begin in the near future. Frank Coker is mayor.

ALTURAS, CAL.—The Alturas Electric Light & Power Company is making extensive improvements to its plant on Pine Creek.

BENICIA, CAL.—Bids will be received at the Benicia Arsenal until Aug. 10 for furnishing electrical supplies, etc. For further information apply to Major J. W. Bennett.

SANTA ANA, CAL.—The Board of Supervisors will receive bids until Aug. 8 for the purchase of a telephone franchise along the roads and public highways of Orange County. C. D. Lester is county clerk.

SAN LUIS OBISPO, CAL.—The Supervisors have adopted an ordinance granting to Russell Robison a franchise to erect and maintain poles for electric wires along certain highways in the county of San Luis Obispo.

SAN FRANCISCO, CAL.—Bids will be received until August 11 by John L. Clem, acting quartermaster, Presidio of San Francisco, for furnishing and installing electric fixtures in the hospital at the Presidio of Monterey, Cal.

PALO ALTO, CAL.—Contracts have been awarded by the Board of Trustees to the Standard Electric Company, of San Francisco, for generators, and to the Westinghouse Electric & Mfg. Company for the motors for the municipal electric lighting plant.

SANTA BARBARA, CAL.—The Board of Supervisors will receive bids until Aug. 6 for a franchise as applied for by the Valley Electric Company to construct wires and other conductors for the transmission of electricity for lighting and heating purposes, along the highways and roads of Santa Maria Valley. G. A. Hunt is clerk of the Board.

YREKA, CAL.—The Siskiyou Electric Light & Power Company is preparing to increase the capacity of its plant at Fall Creek. The company is now installing three new transformers, an additional generator and water wheel. The plant when completed will have a capacity of 4,000 hp. The company has recently purchased water rights on the Klamath River capable of developing about 50,000 hp, at an estimated cost of $400,000.

LEADVILLE, COL.—The citizens voted July 14 in favor of granting Walter W. Davis a franchise for an electric light and power plant.

OURAY, COL.—The Ouray Electric Power & Light Company has discarded its steam plant and is now operating all the machinery by a 700-hp Pelton water wheel. E. A. Phinney is secretary and manager.

NEW BRITAIN, CONN.—An electric motor service to be operated by a 225-kw generator is now being installed at the Stanley Rule & Level Company's plant in this city.

WILLIMANTIC, CONN.—The Board of Aldermen has voted to renew the present contract with the Willimantic Gas & Electric Light Company for city street lighting for a period of five years. The company is contemplating making improvements and increasing the capacity of its plant in the near future.

WINDSOR LOCKS, CONN.—At a meeting of the stockholders of the Windsor Locks Electric Lighting Company, held recently, the directors were authorized to consolidate with the Enfield Gas Company to form the Northern Connecticut Light & Power Company. The old electric light plant at Windsor Locks will be torn down and a new structure erected in its place.

DANBURY, CONN.—The Danbury & Bethel Street Railway Company has commenced improvements which will involve the ultimate expenditure of about $100,000. A blanket mortgage has been given to the American Loan & Trust Company, of Boston, to secure the railway company's bonds. The proceeds from the sale will be applied to the execution of the improvement plans.

WASHINGTON, D. C.—A building permit has been issued to the Potomac Electric Power Company for a 2-story brick power station. F. B. Pyle is the architect. The estimated cost is $23,000.

CONYERS, GA.—The Panola Light & Power Company has recently made improvements and additions to its power station which have doubled the capacity of the plant.

CHARLESTON, ILL.—The directors of the Charleston-Paris Traction Company have arranged for the building of a new interurban line 28 miles long. It will form a connecting link between Indianapolis and St. Louis.

BELLEVILLE, ILL.—It is reported that the officials of the Belleville Deep Well Water Company are considering the question of erecting an electric light plant in Belleville and will make an effort to get the contract for lighting the streets.

PEORIA, ILL.—The Central Railway Company, of Peoria, capitalized at $1,050,000, has been transferred to the Peoria Railway Company, and the street railway property mortgage to the Chicago Title & Trust Company for $3,600,000, the funds from this loan to be used in developing interurban properties in Central Illinois.

BLOOMINGTON, ILL.—Bids will be received until August 3 by the Board of Local Improvement for engines and generators of sufficient capacity to supply current for 500 arc lamps, together with switchboards, exciters, transformers, etc.; also a direct-connected automatic engine and generator, together with switchboard, etc., to run 1,400 16-cp incandescent lamps. Bids are to include the taking out of 7 old arc machines, 320 old lamps and the line shafting now in use. J. S. Neville is chairman.

EVANSVILLE, IND.—The City Council has passed an ordinance requiring all wire using companies to put their wires underground.

EVANSVILLE, IND.—The Evansville Gas & Electric Light & Power Company is considering the construction of a conduit system for its wires.

COLUMBUS, IND.—The Columbus Street Railway & Electric Light Company proposes to erect a large addition to its plant and equip it with a capacity of 10,000 more incandescent lamps.

INDIANAPOLIS, IND.—P. M. Dunn, president of the Indiana Rapid Transit Company, announces that the bonds of the new company have been sold, and work on the line will soon commence. This road will extend from Logansport to Terre Haute.

KEOKUK, IA.—The Mississippi Valley Telephone Company contemplates rebuilding its system in this city at a cost of $100,000.

DES MOINES, IA.—The Des Moines City Railway Company is preparing to build a new central power house, which will cost $200,000.

GREENFIELD, IA.—The Town Telephone, Light & Traction Company has purchased the telephone exchange of the Nexinville Telephone Company in Orient and will take possession Aug. 1.

CHARLES CITY, IA.—The Charles City Water Company will construct an electric power plant; also a concrete dam to replace the old one. Roberts & Abbott Company, of Cleveland, Ohio, are the engineers.

CLINTON, IA.—The Council has passed an ordinance requiring telephone companies to place their wires in underground conduits in the business portion of the city. The Iowa Telephone Company will put in an underground system and construct a new building at a cost of $150,000.

BOONE, IA.—At a recent meeting of the stockholders of the Des Moines, Fort Dodge & Southern Railway Company, held in this city, an amendment to the articles of incorporation was adopted, increasing the capital stock from $2,500 to $1,075,000. This company is building the extensions from Lanyon to Fort Dodge, and from Kelley to Des Moines for the Newton & Northwestern Railway, which will be operated by electricity.

HOPKINSVILLE, KY.—L. M. Shepherd has purchased the plant of the Hopkinsville Gas & Electric Company. It is proposed to improve the system generally.. Danl. Young is superintendent.

PONCHATOULA, LA.—The Flasdick-Rixmann Lumber Company has decided to install an electric system in this town, and contracts have been let for the construction of the plant. F. H. Weldon is general manager.

BANGOR, ME.—The Bangor Railway & Electric Company is installing a storage battery at Kenduskeag.

MILO, ME.—The Milo Electric Light & Power Company is preparing to erect a new power station in this place.

PORTLAND, ME.—The transformer station of the Portland Electric Company, located near Riverton Park, was struck by lighting July 17 and destroyed, entailing a loss of $2,000.

BALTIMORE, MD.—Contracts for the erection of a new power house to be built by the United Railways & Electric Company at Bay Shore Park have been awarded to Charles L. Stockhausen.

CUMBERLAND, MD.—The Edison Electric & Illuminating Company, of this city, is remodeling and increasing the capacity of its plant to 1,000 kw, which will nearly double the capacity of the plant.

LAWRENCE, MASS.—A franchise has been granted by the Board of Aldermen to the Lawrence Automatic Telephone Company.

WESTFIELD, MASS.—The Westfield Power Company proposes to erect an addition to its present plant. A. W. Houghton is the architect.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company has made a voluntary reduction in the price of arc lamps to the city from $96 to $90 per year.

BOSTON, MASS.—Plans are being made by Vorenburg & Company to double the present capacity of their store. The company will also install an electric light and power plant.

WORCESTER, MASS.—The Boston & Worcester Electric Company, which controls the Boston & Worcester Electric Railway, has voted to issue 12,000 shares of additional stock, the proceeds to be used on new work.

EAST BRIDGEWATER, MASS.—The Edison Electric Light Company of Brockton, has applied to the Selectmen for permission to extend its lines into the town for the purpose of supplying electricity for lighting the town.

HOLYOKE, MASS.—The Holyoke municipal lighting plant is to extend its business beyond the city limits. An order has been received from the city of Northampton for three arc lights. W. H. Snow is manager.

NORTH ABINGTON, MASS.—The Abington and Rockland Electric Light & Power Company has decided to increase the capacity of its plant, and will install a new generator at once. The company is also contemplating extending its lines to Hanover.

MIDDLEBORO, MASS.—The Selectmen have granted the Southern Massachusetts Telephone Company permission to construct an underground conduit from the Bridgewater line under Plymouth, Pleasant, Bedford, Centre and School Streets to the Central office.

BOSTON, MASS.—Plans have been prepared by Thompson & Gallaher, 329 Main Street, for an electric lighting and power plant to be installed in the Boston store by the Denholm & McKay Company. The plant will consist of four generators direct connected to four Ames engines, and a Stewart boiler of 420 hp.

GREAT BARRINGTON, MASS.—The Water Commissioners have decided to accept the offer of the Great Barrington Electric Light Company to furnish electricity for the pumping station at the rate of 20 cents per kw hour, and if used 10 hours a day will cost $730 per year. The water has been pumped by a gasoline engine in the pumping station at a cost of $904 per year.

CLINTON, MASS.—The Clinton Gas Company has recently installed a day circuit for power. The company has issued a new scale of charges on a sliding scale basis with the maximum rate of 10 cents per kw-hour, which is half of the present maximum charge for electricity for lighting purposes. Fred L. Fullam is superintendent.

FLINT, MICH.—The Council has granted to H. R. Granger, of Flint, and R. O. Hart, of Flushing, a 30-year franchise for an electric light plant.

OWOSSO, MICH.—The Owosso & Pine Lake Railway Company has the right of way practically all secured for an electric railway from Owosso to Pine Lake.

DETROIT, MICH.—The Home Telephone Company has filed with the city clerk a $6,000,000 first mortgage deed of trust, running to the Commonwealth Trust Company, of St. Louis. The deed is issued to secure a bond issue to extend and increase the independent telephone system which the company is constructing in this city. A bond issue of $3,250,000 will be made immediately, and $2,750,000 of these bonds, secured by the trust deed, will be held for future use in extending the system.

STILLWATER, MINN.—The Gas & Electric Co. has decided to erect a new sub-station.

FAIRMONT, MINN.—The question of improving the water works and electric light plant is under consideration.

ST. CLOUD, MINN.—The Mississippi River Power Company will soon commence the construction of a new dam at Clearwater, 12 miles south of St. Cloud.

ST. PAUL, MINN.—A permit has been issued for a power plant for the West Side Power, Heat & Light Company, to cost $25,000. W. H. Brink is superintendent.

STAPLES, MINN.—Bonds to the amount of $70,000 have been voted for water works and an electric light plant. Claussen, Burch & Pillsbury, of St. Paul, are the engineers.

KELLEHER, MINN.—The citizens of this town are considering the establishment of an electric light and water works plant. Stoner & Jewett, of Bemidji, Minn., are the engineers.

ST. PAUL, MINN.—The St. Paul Merchants' Patrol & Electric Protective Company has applied for a franchise for conducting district telegraph service, including fire alarm, burglar alarm, electric sprinkling and watchman signal service.

OSYKE, MISS.—It is stated that an election will soon be held to vote on issuing $25,000 bonds for water works and an electric light plant.

APPLETON CITY, MO.—At a recent election the citizens voted to issue $10,000 bonds to construct a municipal electric light and power plant.

KANSAS CITY, MO.—R. A. Long and John Bryant have applied to the City Council for a franchise to sell electricity for light and power in certain districts of the city.

DAYTON, MO.—The Kimmswick, Hillsboro & Northern Railway Company has filed a petition in the County Court in Clayton asking for a franchise to construct an electric railway through the Southern portion of St. Louis County.

ANACONDA, MONT.—The City Council has granted an electric light franchise to W. H. Reber.

BILLINGS, MONT.—The Rocky Mountain Bell Telephone Company will make extensive improvements to its system in this city.

GLASGOW, MONT.—Bids will be received until August 1 by J. J. Mullins, town clerk, for furnishing material and constructing a water works and electric light plant complete. A. W. Mahon is city engineer.

HELENA, MONT.—The Rocky Mountain Bell Telephone Company has decided to expend about $1,000,000 in improvements to its system, the greater portion of which will be spent in Montana. New buildings are to be erected in Great Falls, Bozeman and Livingston and 400 miles of additional toll lines will be constructed this year. George Y. Wallace is president.

RENO, NEV.—Ten thousand miner's inches of water, practically the entire flow of Carson River, has been taken up for power purposes by John Humphrey, representing the Goodyear Rubber Company. As soon as the company perfects the title a 500-hp generating station will be erected.

FRANKLIN FALLS, N. H.—William M. Ames, of Berwick, Me., has been awarded the contract for the construction of the new dam and power house for the Franklin Light & Power Company at the Giles mills.

ELIZABETH, N. J.—The City Council has decided to invite bids for lighting the city for 1, 2, 3, 4 and 5 years. The present contract expires September 1.

ROCKAWAY, N. J.—At an election held July 18 the citizens voted in favor of issuing bonds to provide for the purchase of a municipal lighting plant.

BOGOTA, N. J.—The Borough Council has awarded the contract for street lighting to the Public Service Corporation of New Jersey for $22.50 per light per year.

FLEMINGTON, N. J.—The Farmers' & Merchants' Telephone Company has increased its capital stock from $30,000 to $40,000 for the purpose of extending its system.

WEST ORANGE, N. J.—The Town Council on July 17 awarded to the United Electric Company the contract for lighting the streets for 5 years at $85 per lamp per year for 130 arc lamps.

HADDONFIELD, N. J.—The contract for the erection of a telephone exchange for the Delaware & Atlantic Telephone Company has been awarded to J. S. Cornell & Son. The building will cost $40,000.

ROCHESTER, N. Y.—The clerk of the Board of Contract and Supply has been instructed to procure bids for lighting the city for 1, 2 and 5 years, beginning July 1, 1907.

TROY, N. Y.—Arrangements have been completed by the Commercial Telephone Company for taking over the Saratoga Telephone & Telegraph Company and the new Union Telephone Company, of Glens Falls.

UTICA, N. Y.—The Mohawk Valley Brick & Supply Company will operate its works with electricity, and has entered into a contract with the Hudson River Electric Power Company to furnish the energy for its plant.

SCHENECTADY, N. Y.—The Schenectady Illuminating Company has filed a certificate of extension with the Secretary of State to give the company the right to manufacture and sell electricity for lighting, heating and power purposes in the counties of Albany, Saratoga and Montgomery.

GLENS FALLS, N. Y.—The Hudson River Electric Power Company has completed its transmission line from Ballston to Amsterdam, thus connecting the latter town with the large generating plant at Spier Falls. Work will commence in a short time on the extension of the line to Utica.

NIAGARA FALLS, N. Y.—The International Power & Transmission Company, which was organized to distribute electricity in Lockport, has elected the following officers: Patrick F. King, of Niagara Falls, president; William Richmond, of Lockport, second vice-president; William H. Higgs, of Lockport, secretary.

UTICA, N. Y.—The Mohawk Valley Company has increased its capital stock from $10,000,000 to $20,000,000. The Mohawk Valley Company is the operating company for the trolley properties which the New York Central has acquired in recent years, including the Utica & Mohawk Valley, the Syracuse Rapid Transit Company and the Rochester lines.

BROOKLYN, N. Y.—Bids will be received until July 30 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electrical equipment in School No. 6, Borough of Brooklyn, and electrical equipment in addition to School No. 1, Tottenville, Borough of Richmond; also for installing electric generating equipment in Stuyvesant High School, Borough of Manhattan.

BROOKLYN, N. Y.—The New York Dock Company is installing a storage battery plant adjoining the power house at the foot of Pacific Street. The dynamos adjoining supply the hoisting engines along the docks, and the object of the storage plant is to prevent the waste of power when fewer hoisters are at work than the power is meant to operate. The new plant will furnish 240 amperes at 250 volts.

BLUITTS FALLS, N. C.—Lockwood, Greene & Company, 93 Federal Street, Boston, Mass., engineers for Hugh McRae & Company, of Wilmington, N. C., in the development of Bluitts Falls, write that all contracts have been placed and the work is now under construction.

RALEIGH, N. C.—Judge Thomas H. Purnell has ordered C. H. Belvin and E. Maxwell permanent receivers in the case of the Schenectady Trust Company versus The Cape Fear Power Company, following a temporary receivership, made early in June. The receivers are ordered to proceed with the development and are directed to enforce all contracts and sub-contracts. This plant is well under way, and the amount involved is about $400,000.

HILLSBORO, N. D.—The Trail County Telephone Company has increased its capital stock from $30,000 to $50,000.

BELLAIRE, OHIO.—The Wheeling Traction Company has been granted a franchise for the extension of its Bellaire division to Shadyside. The line will be built this fall.

NEWBURG, OHIO.—A company headed by Eugene Quigley has notified the Village Council that it will apply for a franchise to illuminate the streets and furnish commercial lighting.

WELLSBURG, OHIO.—The Council has granted a franchise to the proposed Steubenville, Wellsburg & Bethany Traction Company. President Cramblett, of Bethany College, Bethany, is interested in the project.

CINCINNATI, OHIO.—Plans have been completed for a pumping and condensing station to be erected adjacent to the East End power station by the Cincinnati Traction Company. The generating capacity of the station will also be increased.

CLEVELAND, OHIO.—The Forest City Railway Company has completed plans for a power plant, and will shortly place contracts for steam and electrical equipment for the station, which will have a capacity of 2,000 hp.

DAYTON, OHIO.—The Council has passed the new lighting ordinance, which provides for receiving bids from arc lighting companies, electric incandescent lamps, gas mantle lamps and for current only. The contract may be let in whole or in part.

HAMILTON, OHIO.—At a recent meeting of the City Council it was decided to call an election on Sept. 1, to submit to the voters the question of issuing $305,000 of bonds for improvements to the electric light plant, gas plant and water works.

SANDUSKY, OHIO.—The Toledo, Port Clinton & Lakeside Railway, operating from Toledo to Marblehead, has secured a right of way for an extension from Wahlers Station to Boeschen's Dock, from which a ferry will be operated to Sandusky and Cedar Point.

STEUBENVILLE, OHIO.—The Ely syndicate, which recently acquired the plants and business of the Steubenville Traction & Light Company of Steubenville, and the Toronto Gas & Electric Company, of Toronto, has applied for a franchise to illuminate the city of Cumberland, W. Va.

DELAWARE, OHIO.—A syndicate headed by John J. Swartz, a Columbus, O., broker, has asked for an option on the plant and business of the Delaware Light, Heat & Power Company. The company has a capital stock of $125,000, and Rev. C. Lamb is president and J. G. Rosenthal, secretary.

DAYTON, OHIO.—The Indiana, Columbus & Eastern Railway Company is planning important improvements to its western division, among which is the double tracking and improving the line between Dayton and Springfield and increasing the capacity of the power station at Medway. J. L. Adams is general manager.

ELYRIA, OHIO.—The Elyria Milling & Lighting Company has applied to the Village Council for a franchise to string wires on the streets of the city. The company is enlarging its power plant and proposes to furnish commercial light to concerns in the business section of the city. It has also announced that it will bid for the city lighting when the present contract expires.

BELLEVUE, OHIO.—Stockholders of the Bellevue Home Telephone Company met last week and voted favorably on a proposition to increase the capital stock of the company from $10,000 to $100,000. The proceeds of the increase are to be used in improvements to the plant and plans and specifications have been prepared for the new equipment and bids will be asked for in the near future.

KENTON, OHIO.—The citizens of Kenton have raised the amount required as its share of a preliminary fund to secure the building of the Lima, Kenton & Marion Railway, which will connect the two cities. W. H. Ogan, of Dayton, the chief promoter of the project, states that arrangements have been made for the sale of $1,250,000 of bonds for the construction of the road.

OXFORD, OHIO.—Bids will be received until August 16 by John W. Herron, president Board of Trustees of Miami University, for engines, single-phase, alternating-current generators, switchboard, transformers and inside and outside wiring, for an electric light plant to be erected on the campus for the University. Bids will be received separately or as a whole for the work. Gustave W. Drach, Union Trust Building, Cincinnati, Ohio, is the architect.

CLEVELAND, OHIO.—Director Springborn of the Board of Public Service has submitted to the Federal authorities a plan to illuminate and heat the various Federal buildings in Cleveland, including the new post office, from the municipal lighting and heating plant which the city will install in the new city hall building now under construction. It is the plan to erect a large central power station to heat and light all the buildings in the proposed group plan of public buildings in the downtown section of Cleveland.

OKLAHOMA, OKLA.—The Pioneer Telephone Company has recently purchased 160,000 feet of cable at a cost of $46,800 for use in this city and has placed orders for twenty carloads of cross arms, and for five carloads of insulators to be used on the long-distance lines.

KLAMATH FALLS, ORE.—The Klamath Falls Light & Water Company, of which H. V. Gates is president, plans to expend about $20,000 this season in extensions of its light and water systems. The electric lighting system will also be extended, and electric power will be supplied to the street railways.

YORK, PA.—Surveys have been made by the York County Traction Company for a new line from New York to Hanover.

JOHNSTOWN, PA.—The promoters of the Dale Light, Heat & Power Company have applied for a franchise for the purpose of furnishing electricity for lighting in this city.

HARRISBURG, PA.—The Paxtang Electric Company is preparing extensive improvements and increase the capacity of its plant, and is in the market for a 500-kw generator, new engine and boiler. C. W. Lynch is president.

PHILADELPHIA, PA.—The Charles McCaul Company has secured the contract for the erection of the new Diamond exchange, for the Bell Telephone Company, which will cost about $135,000. John T. Windrim is the architect.

PITTSBURG, PA.—Bids will be received until August 18 by Major William L. Sibert, Corps Engineers, U. S. A., Pittsburg, for building a power house at new Lock No. 3, Monongahela River, three-fourths of a mile above Elizabeth, Pa.

UNION CITY, PA.—The Union City Electric Light Company has secured the contract for lighting the borough for five years with 58 arc and incandescent lights at about $1,938 per year. It is stated that the company will expend about $5,000 in improvements.

PITTSBURG, PA.—Work has commenced on the new electric lighting plant of the Duquesne Light Company. The plant will be located near the East Liberty depot and will cost $250,000. Contracts for the electrical equipment have been placed with the General Electric Company.

PUNXSUTAWNEY, PA.—The Jefferson Traction Company will soon commence the construction of an electric railway connecting Indiana and Punxsutawney, a distance of over 50 miles. The line will ultimately connect Punxsutawney, Reynoldsville and Du Bois with Pittsburg.

HARRISBURG, PA.—The Board of Trustees of the Pennsylvania State Hospital has awarded the contract for the addition to the central power plant of the institution to the York Engineering Company for about $18,000. The equipment will include two additional 300-hp water-tube boilers.

CHESTER, PA.—Application will be made on August 3 for a charter for the Tinicum & Sharon Hill Railway Company for the purpose of building a line from Sharon Hill to Tinicum Road, Philadelphia. The proposed incorporators are Walter A. Rigg, J. Milton Miller, Harry H. Reigel, W. A. Rosen and W. S. Bell.

PITTSBURG, PA.—Contracts have been let to the Westinghouse Electric & Manufacturing Company by the Pittsburg Railways Company for three 7,500-hp and one 5,000-hp turbo-generators to be installed in its power plant on Brunots Island. The new generators will furnish electricity for the power and lighting circuits, and the street railway lines.

EASTON, PA.—A mortgage for $500,000 given by the Easton & South Bethlehem Transit Company to the Girard Trust Company, of Philadelphia, to obtain bonds, has been filed of record in Northampton County. The new trolley company is controlled by the capitalists who own the Easton Transit Company, and will be operated in conjunction with the latter's lines in this section.

POTTSVILLE, PA.—Work on the installing of an electric lighting plant at the Sterling Colliery has commenced, which, when completed, will furnish electricity for lighting all the collieries owned by the Philadelphia & Reading Railroad Company in the Shamokin district. It is stated that it is the intention of the company to ultimately operate the mines entirely by electric power.

MIDDLE CREEK, PA.—The dam, which is being constructed by the Middle Creek Electric Company on Middle Creek, will be completed about the first of October. At first about 400 hp will be developed; the company is already planning to extend it to 1,000 hp. The company will supply Sunbury and Northumberland, and later other sections of Snyder County with electricity for lighting and power. The officers of the company are: E. M. Leader, of Shamokin, president; George W. Wagenseller, of Middleburg, secretary; Frank P. Llewellyn, of Shamokin, treasurer; Waldo Shipman, of Sunbury, superintendent.

BETHLEHEM, PA.—The South Bethlehem and the South Bethlehem & Saucon Street Railway Companies have filed articles of association at the Court House. The South Bethlehem line is to cover a number of streets in Bethlehem and pass through the villages of Seidersville, Colesville and Freidensville, a distance of seven miles. The company has a capital stock of $42,000. The directors are C. P. Hoffman, William H. Lauer, U. H. Wiland, P. F. Carmen, Thomas H. Mulligan. The South Bethlehem & Saucon Company will extend its line to the southern limits of Freidensville, a distance of 5 miles. The company is capitalized at $30,000. The directors are Andrew L. Cope, C. P. Hoffman, W. H. Lauer, W. H. Miller and U. H. Wiland.

HUNTINGDON, PA.—The construction of the large hydro-electric plant of the Juniata Hydro-Electric Company on the Juniata River, near Warrior Ridge station, is progressing rapidly. The dam and power station will be completed by October 1, by which time most of the machinery will be installed. The construction of the second plant, which will be located at the lower end of the gap, will be started soon. The two plants when completed will contain nine 1,000-hp turbines direct-connected to 500-kw alternating-current generators. In addition to the hydraulic generating units there is being installed a completed steam plant, consisting of four Curtis steam turbines with a total capacity of 4,500 hp, which will be put in service during low water, or in other emergency. The construction of the transmission lines will commence soon. Other power plants in addition to those at Warrior Ridge are to be constructed, all of which will supply the same transmission system. With the additional plants contemplated the total output of the system will be 20,000 hp, and will cost about $2,500,000. The company will furnish electricity for lighting, electric railways and industrial plants throughout Juniata Valley, with transmission lines and distributing stations extending from Altoona to Lewiston.

SPEARFISH, S. D.—The Black Hills Traction Company expects to have its large hydro-electric plant, which is now being constructed at Redwater, completed and in operation by Oct. 1. The plant will generate 1,500 hp, and is being constructed in two separate units, either of which is capable of carrying the whole load. The Westinghouse Electric & Manufacturing Company will furnish the electrical equipment, and the Belden Waterwheel Company, of Philadelphia, Pa., the hydraulic machinery. A transmission line from the plant to Deadwood, 21 miles in length, is now being built. The company will furnish electricity for mines and mills through the territory which its lines run.

JACKSON, TENN.—The Louisville syndicate which recently purchased the electric railway and other electric utilities of Jackson, Tenn., has incorporated the Jackson Railway & Light Company with $600,000 capital stock. The company will build a new power plant; will increase the mileage of the electric road from 3½ to 11, and will build a suburban line 3 miles in length to Beemis.

EL CAMPO, TEX.—The Bailey Mills Company, of Victoria, secured the contract to construct the electric light, water and ice plant at El Campo.

HOUSTON, TEX.—The Southwestern Telegraph & Telephone Company has filed a petition with the city secretary asking permission to lay underground conduits in the portions of First and Fifth wards of the city. The company contemplates the construction of 7,000 feet of conduits this year.

FORT WORTH, TEX.—The Southwestern Mechanical Company has made application for a franchise to erect poles and string wires for distributing electricity in this city. The company has submitted a proposition to the city to supply the city with electricity for lighting; the service to be furnished at cost.

FORT WORTH, TEX.—It is reported that a new traction company, to be organized with Eastern capital, is to absorb the Fort Worth & Arlington Heights Traction Company, the Fort Worth & Rosen Heights Street Railway Company, and the Citizens' Light & Power Company, and that the new company is to construct an interurban line between Fort Worth and Mineral Wells and is to build a large power house at Arlington Heights.

GALVESTON, TEX.—Specifications are on file at the office of the Electrical World, New York, N. Y., for furnishing, delivering and erecting at the Galveston city water works and electric light plant, four 200-hp water-tube boilers, with all steam, feed water and smoke connections, together with removing six old boilers, settings and connections; bids will also be received under separate contract for the construction of a chimney 72 inches x 125 feet, complete, with foundation, to be of brick, concrete steel or a self-supporting steel stack, bids for both contracts to be received until August 30.

PROVO, UTAH.—W. E. Harding, city recorder, writes that Frank C. Kelsey, of Salt Lake City, is the engineer for the proposed electric light plant.

HUNTSVILLE, UTAH.—The Utah Light & Railway Company, of Ogden, has petitioned for a franchise to furnish this city with electric power and lighting.

ROANOKE, VA.—The Roanoke Railway & Electric Company has recently sold $50,000 of its bonds, the entire proceeds of which will be expended in improvements.

LEXINGTON, VA.—Plans are being prepared by E. C. Wiley, of Lynchburg, for a heating and lighting plant, to be installed in the Virginia Military Institute buildings this fall.

NATIONAL SOLDIERS' HOME, VA.—Bids will be received until August 14 by B. A. Beeson, treasurer National Soldiers' Home, for furnishing and installing three new 150-hp steam boilers and removing five old steam boilers at the Southern Branch.

WALLA WALLA, WASH.—The Northwestern Gas & Electric Company has filed amended articles to its charter, to allow the purchase and operation of electric railways.

SUNNYSIDE, WASH.—Bids will be received by H. W. Turner, town clerk, until August 13, for furnishing material and constructing water works and an electric light plant.

TACOMA, WASH.—A franchise has been granted by the County Commissioners to the Tacoma Railway & Power Company for right of way, outside of the city limits at South Tacoma for the extension of its line to American Lake.

BOLSTER, WASH.—The Mad River, Bluffton Mining Company, Olentanga and Copper Mountain Mining companies are considering the establishment of an electric light and power plant at Bolster for the purpose of supplying the above properties with electricity for light and power.

APPLETON, WIS.—The Wisconsin Telephone Company will install a complete new system in this city.

KILBOURN, WIS.—L. Kleimenhagen, village clerk, writes that the Southern Power Company, of Madison, will construct a dam at Kilbourn. Daniel W. Mead, of Madison, is engineer.

MILWAUKEE, WIS.—The Board of Trustees of the County Hospital, Almshouse and Outdoor Relief for Poor Department, is considering the construction of a new heating and power plant at the poor house. The probable cost is $15,000.

EAU CLAIRE, WIS.—Plans and specifications have been completed and work will soon commence on the improvements on the Wisconsin Telephone Company's system in this city. The company will expend between $50,000 and $60,000.

MANITOWOC, WIS.—Actual work of construction has been begun on the new Fox River Electric Railway, from this city to Sheboygan at Cleveland station. The line is 25 miles long and will form the connecting link between this city and Milwaukee, and will connect with the outlying branches of the Manitowoc & Northern Traction Company of this city and the Sheboygan company at Sheboygan. The new line is capitalized at $250,000. Because of the central location, the power house will be stationed at Cleveland. All of the right of way has been secured, with the exception of about 3 miles.

CHEYENNE, WYO.—The Northern Colorado Power Company, which recently purchased the Cheyenne electric and power plant, is arranging to install an electric street railway here. The line will later be extended to Greeley, Fort Collins and other Northern Colorado towns.

BRENDA, MAN.—The Melita-Arthur Telephone Company, Melita, Man., has made application for a franchise to install a telephone system in this town and for building long-distance lines to connect with other towns.

WINNIPEG, MAN.—Bids will be received by Alderman J. E. Gibson, Chairman Fire, Water and Light Committee, until August 27, for the supply of two turbine pumps with electric motors for the city water works. Specifications and forms of tender can be obtained from Col. H. N. Ruttan, city engineer.

TORREON, MEX.—The contract will soon be let for installing the electric light and power plant at Torreon. The plant will cost about $250,000.

MEXICO CITY, MEX.—Messrs. G. & O. Braniff & Company, of Mexico City, will install a large hydro-electric plant at a waterfall at the point of confluence of the Blanco and Purificacion Rivers, near Aramberri, in the State of Nuevo Leon.

MASCOTA, MEX.—A large hydro-electric plant is to be installed at the Chorro del Embocadero water fall, situated 12 kilometers from Mascata. Carlos Izquierdo and Miguel Izquierdo have applied to the state government for the necessary concession for the enterprise. The proposed plant will be used to supply Mascota with electricity for light and power. Transmission lines will also be built to other towns adjacent to the plant.

JAMAY, MEX.—The government of the State of Jalisco has exempted from taxes for a period of 15 years the transmission lines and distributing stations to be erected by Fructuoso Castellanos in supplying electrical power to Jamay, Ribera Castellanos and Octolan. Mr. Castellanos will secure the power from the Guanajuato Electric Light & Power Company at La Barca.

MEXICO CITY, MEX.—W. W. Wheatley and W. J. Sherwood, president and secretary respectively of the Perico Exploration Company of Mexico City, have applied to the Mexican government for a concession to use the water of the San Geronimo de Voblanes River in the State of Jalisco for generating electric power from a hydro-electric plant which they propose to install.

PACHUCA, MEX.—The Compania Electrica e Irrigadora de Hidalgo, which has its headquarters at Pachuca, is preparing to make extensive improvements and enlargements. This company furnishes 40,000 hp for the operation of mines and industrial plants in Pachuca and adjacent territory. Some of its transmission lines are 60 miles long. Chief Engineer Emilio Pinson recently visited the United States for the purpose of purchasing additional machinery.

SANTA ROSALIA, MEX.—Paul Ginther, of Santa Rosalia, and Joequin Cortazar, of Chihuahua, who recently obtained a concession from the State of Chihuahua to install a large hydro-electric plant on the Conchos River, are preparing to erect a dam about 18 miles from Santa Rosalia. Engineers who have made a survey for the project report that nearly 35,000 hp can be generated. Transmission lines will be built to Santa Rosalia, Chihuahua, Parral, Torreon and other towns and industrial centers.

MEXICO CITY, MEX.—The Mexican Congress has granted an additional concession to the Mexican Light & Power Company under the terms of which that company is given the right to use the waters of several more streams in the neighborhood of Necaxa for generating electric power. By the use of these waters the total available horsepower of the company will be increased to 180,000 hp. This company recently purchased the Tuxipango water power of the Rio Blanco, located near Orizaba. It is intended to develop 30,000 hp from this waterfall and transmit it to the city of Puebla. The company has decided to extend its transmission lines into the city of Pachuca, and a distributing station, for handling the 60,000-volt current from Necaxa, will be put on the main transmission line at Irolo. From this point the transmission lines will be built to Pachuca and Puebla.

Company Elections.

LENOX, MASS.—At the annual meeting of the Lenox Electric Light Company, held July 17, the following directors were elected: Thomas Post, Henry Sedgwick, William D. Curtis, Benjamin Rogers, Murray A. Brown, I. J. Newton, William G. Clifford and Peter McGoldrick.

MECHANICVILLE, N. Y.—At the annual meeting of the Mechanicville Electric Light & Gas Company, held recently, the following officers were elected: Edwin Farrow, president and treasurer; James A. Greenway, vice-president; M. J. Farrow, secretary.

TONAWANDA, N. Y.—At the annual meeting of the directors of the Tonawanda Power Company and the Suburban Power Company, held recently, the following officers were elected: D. O. Mills, of New York, president; De Lancey Rankine, of Niagara Falls, vice-president; F. L. Lovelace, of Niagara Falls, secretary; W. Paxton Little, of New York, treasurer; Frank M. Gordon, of North Tonawanda, assistant treasurer.

TROY, N. Y.—At the annual meeting of the stockholders of the Commercial Union Telephone Company, held recently, the following directors were elected for the ensuing year: John T. Christie, W. Levis Burk, William Connors, Cornelius V. Collins, Stephen C. Medberry, Charles W. Cool, Edward Davis, James H. Caldwell, Peter McCarthy, William

C. Geer, William D. Mahoney, Edgar T. Brackett, Brodgie G. Higley, Arthur MacArthur. Subsequently the directors organized as follows: President, John T. Christie; first vice-president, James H. Caldwell; second vice-president, Edward Davis; secretary, W. Levis Burk; treasurer, Peter McCarthy; assistant treasurer, William C. Colburn.

CANTON, OHIO.—The Merchants' Light, Heat & Power Company has been reorganized by the election of C. R. Morley, of Cleveland, president; A. Turner, Canton, vice-president; David Morison, Cleveland, second vice-president; E. Wiebenson, Cleveland, treasurer, and S. Steiner, Canton, secretary.

PETERSBURG, IND.—At the annual meeting of the stockholders of the Spurgeon Telephone Company the following directors were elected: B. A. Humphry, Samuel Wheeler, Charles Strunk, Thomas Connor, George Taylor, P. M. Ferguson, John Jordan, J. A. Wiggs, Alva Shepard, and W. H. Stephens.

New Industrial Companies.

THE DENDELL ELECTRICAL & MANUFACTURING COMPANY, of San Francisco, Cal., has been incorporated with a capital stock of $25,000, by A. E. Dendell, E. M. Schlessinger and Elizabeth J. Dendell.

THE SIMPLEX TELEPHONE EQUIPMENT COMPANY, of Rochester, N. Y., has filed articles of incorporation with the Secretary of State with a capital stock of $300,000. The directors are J. A. Nolan, J. R. English, and R. Fahrenfeld, of Rochester.

THE LEWIS POWER COMPANY has been incorporated with a capital stock of $40,000 for the purpose of manufacturing auto cars, railway cars, etc. The incorporators: H. Oppenheimer, F. Kopper, Jr., E. A. Weed, of New York City; O. P. Lewis and F. V. Lewis, of Brooklyn.

THE PROVIDENCE ELECTRO-MAGNETIC COMPANY has been incorporated with a capital stock of $50,000 by J. B. Howlihan, of New York City; P. Kelly, of Jersey City, N. J.; Gerald Murphy, of New York City. The company proposes to manufacture electrical devices, etc.

THE CLEVELAND RAILWAY PROMOTION COMPANY, Cleveland, Ohio, has filed articles of incorporation with a capital stock of $10,000, for the purpose of promoting and building electric railways. The incorporators are W. M. Hagen, A. W. Thomas, Max P. Goodman, C. F. Burton and F. B. Krause.

THE CONSTRUCTING AND MAINTAINING COMPANY, of Baltimore, Md., has been incorporated with a capital stock of $5,000 by Charles D. Purroy, Edward I. Pearson, Walter Haines, Lillian Purroy, Helen A. Pearson and Harry Hechheimer. The company proposes to deal in electrical appliances and vehicles.

THE D. K. CARPENTER COMPANY, of Brockton, Mass., has filed articles of incorporation with a capital stock of $3,000. The incorporators are Dauphin K. Carpenter, president; Albert G. Blair, vice-president; Harry H. Williams, treasurer, all of Brockton. The purpose of the company is gas and electrical construction, etc.

DOUB MANUFACTURING COMPANY, of Pittsburg, Pa., has been incorporated to manufacture and deal in electrical devices, incandescent lamps and other devices. The incorporators are A. F. Bennett, Pittsburg; Frank Montgomery, Allegheny; W. J. Benson, Homestead, and Oscar Doub, Crafton. The company has a capital of $75,000.

THE BUXTON CONSTRUCTION COMPANY, of Portland, Me., has been granted a certificate of incorporation with a capital stock of $50,000. The officers are: Carl Dennett, of Bangor, president; C. S. Erswell, of Brunswick, treasurer. The purposes of the company are to carry on the business of engineering, contracting and construction in all its branches.

New Incorporations.

MONTGOMERY, ALA.—Articles of incorporation have been filed with the Secretary of State for the Citizens' Light & Power Company by Alexander Rice, J. L. Combs and others. The company has a capital stock of $100,000.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed with the county clerk for the Watsonville Light & Power Company, with a capital stock of $250,000. The incorporators are F. M. Fay, J. C. Love, D. H. Foote, C. W. Waller and A. W. Linforth.

CEDARVILLE, CAL.—The Surprise Valley Electric Light & Power Company has been organized for the purpose of constructing a transmission line from the Pine Creek plant into Surprise Valley, a distance of 17 miles, for the purpose of furnishing electricity for lighting and power purposes.

LOS ANGELES, CAL.—Articles of incorporation of the Home Telephone & Telegraph Company, with an authorized capital of $10,000,000 stock and $10,000,000 bonds, have been filed in the office of the county clerk. The incorporators are local capitalists. The company has been organized to take over the Home telephone plants in several Southern California cities.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Coast Counties Light & Power Company by Leo. H. Susman, Henry Mallcoh, L. W. O. Pryor, Walter J. McLean, Henry Bostwick, William B. Bosley and Raymond A. Morton. The company has a capital stock of $1,500,000.

HARTFORD, CONN.—The Manila Suburban Railways Company, of this city, has filed a certificate of incorporation. It has taken out a franchise for the construction and operation of various classes of railroads in and around the city of Manila, and it is also authorized to operate telegraph and telephone systems. The capital stock of the company is $500,000. The incorporators are Arthur L. Shipman, Charles Welles Gross and Alvan Waldo Hyde.

WILMINGTON, DEL.—The Chester Electric Company has filed articles of incorporation with a capital stock of $300,000.

BLOOMINGTON, ILL.—The East Side Heat, Light & Fuel Company has filed articles of incorporation with a capital stock of $100,000. The incorporators are Samuel White and others.

MOOREFIELD, IND.—The Farmers' Mutual Telephone Company has filed articles of incorporation with the Secretary of State. Its principal exchange is in Mooreville. A. K. Smith, Clarence Coller, Scott Donner and C. N. Brown are the directors.

BLOOMINGTON, ILL.—Articles of incorporation have been filed with the Secretary of State for the East Side Heat, Light & Fuel Company by Samuel R. White, Ora E. White and John J. Pitts.

CHICAGO, ILL.—Articles of incorporation have been filed with the Secretary of State for the Majestic Service Company with a capital stock of $2,500 by E. A. Larson, Edmund A. Adcock and Colin H. Fyffe. The company propose to produce and sell heat, steam and electricity.

SPRINGFIELD, ILL.—The Effingham & Olney Interurban Railroad Company, Eberle, Ill., has been incorporated; capital stock, $2,500; incorporators and first board of directors: Dr. R. S. Wishard, Daisy Wishard, G. M. Merry, Henry Richards, Eberle, Ill.; Theron Gould, Bible Grove, Ill.

SPRINGFIELD, ILL.—The Carthage & Western Illinois Electric Railway Company has been incorporated, with principal offices at Chicago; capital stock, $2,500. Incorporators and first board of directors: W. M .R. Vose and F. P. Vose, Evanston, Ill.; C. C. Bruer, Ralph A. Griffen and George A. Griffen, Chicago.

SOMERSET, MASS.—The Somerset Gas & Electric Light & Power Company has been organized with Alden K. Clear, of Providence, R. I., as treasurer, and W. N. Crowell general manager. The company will soon apply for a franchise.

Legal.

PROPER APPLIANCES AND NEGLIGENCE.—The Supreme Court of Orgeon has affirmed the decision in favor of the defendant in the suit of Blust versus the Pacific States Telephone Company, where the plaintiff lineman in putting up cable was injured by the sudden giving way of the cable support rigging. The court held as follows: (1) Though a master is bound to use due care to provide suitable and safe materials, he is not bound to provide the latest and most improved, and is not guilty of negligence where he provides appliances which are safe and sufficient when properly used. (2) A telephone company is not negligent in failing to prescribe rules for work for its servants engaged in putting up a telephone cable. (3) An experienced telephone lineman, familiar generally with the methods of putting up telephone cables, and particularly with the method used by his employer, who entered and continued in the employment without objection to the method used, assumed the risk of injury from the falling of the cable.

Obituary.

MR. D. C. DEWAR, Montreal, manager of the Bell Telephone Company of Canada, died suddenly of heart disease at the King Edward Hotel, Toronto, where he was staying with his wife on a health-seeking trip. He was born at St. Andrews, Quebec, and was only 44 years of age. He leaves a widow and four children.

MR. C. E. GRAY.—Charles E. Gray, a telegrapher in the employ of the Western Union, who for eighteen years had worked as an operator in the telegraph department of *The Sun*, died on July 19 at his home in Brooklyn, N. Y. He was born in Titusville, Penn., forty-nine years ago and became a telegraph operator when fifteen years old. Before entering the service of the Western Union Company he was with the Commercial Bulletin Company and the old United Press. He leaves a widow and two daughters.

MR. RUSSELL SAGE died at his country residence, Lawrence, L. I., on July 22, in the ninetieth year of his age and the eightieth million dollar of his fortune, made by shrewd trading, stock jobbing and money lending. As a friend of Mr. Jay Gould he became early interested in telegraphic affairs, but as a director is not known to have done any special original or creative work. At the time of his death Mr. Sage was director of the Western Union Telegraph Company, Manhattan Railway Company, American Telegraph & Cable Company, American Union Telegraph Company, Chattanooga, Empire and Bay State Telegraph Company, Gold & Stock Telegraph Company, New York Mutual Telegraph Company, and the Washington and New Orleans Company. No list is at present available of the electrical securities that he held.

MR. J. SALTAR, JR.—The sudden death of Mr. John Saltar, Jr., on July 12 deprives the engineering profession of one of its most active members. Mr. Saltar was a graduate of the Rensselaer Polytechnic Institute, of Troy, N. Y., class of '67. Upon graduation he accepted a position as civil engineer with an Eastern railroad, later being appointed city engineer of Saratoga, N. Y., where he served for some time. Later his services were secured by the government of Equador, where he was given charge of important works going on at that time; upon the successful completion of which he again turned his attention to railroad work in this country, finally accepting a position with the N. Chicago Steel Works. This position he resigned in 1881 to accept the management of the Western department of the Otto Gas Engine Works, of Philadelphia. About seven years ago he was elected president of the company, which position he held at the time of his death. Under his efficient management all the larger sizes of the Otto engines have been perfected and placed on the market. His name is probably best known to the engineering world, however, as the inventor of submarine boat engines, now being used throughout the world. Mr. Saltar was an active member of the Masonic order, and of the Western Society of Mechanical Engineers. The interment took place at Rockford, Ill., the place of his birth.

Personal.

MR. HORACE BUCK, who for two years past has been general manager of the Bucksport, Me., Light & Power Company, has bought recently a controlling interest in that corporation.

MR. R. L. CAMPBELL, of Atlanta, Ga., has become associated with the Stanley-G. I. Company, and will have charge of its local engineering work, etc., with headquarters in the Empire Building.

MR. TYNDALE PALMER, vice-president of the Union Terminal Company, of New York, has been traveling in Western Iowa, studying the project to construct a long trolley line from Omaha to Des Moines.

MR. W. H. SCHOBIE, for many years assistant purchasing agent of the Big Four Railroad, at Cincinnati, Ohio, has resigned, and has accepted a position as purchasing agent of the Pittsburgh Gage & Supply Company, of Pittsburgh.

MR. W. E. LAIRD, superintendent of the Telelectric Company, of Pittsfield, Mass., and formerly in the experimental department of the Stanley-G. I. Company, is taking up a new line of work, and will probably soon establish a plant there.

MR. J. H. LATHAM, an electrical engineer with the Winston Electric Construction Co., was struck by lightning while at the telephone in the railway yards, St. Asaph, Alexandria County, Va., and was seriously injured by the concussion and mental shock. He has been under treatment at the Alexandria Hospital.

MR. CHARLES A. MOORE, JR., secretary of Manning, Maxweli & Moore, New York; Mr. Homer Davenport, the cartoonist, and J. H. Thompson, Jr., sailed on July 5 on the *La Lorraine* for Arabia, to purchase 16 thoroughbreds for breeding purposes. They will go 600 miles into the interior with a large escort.

MR. ROBINETT SCRUBY, electrical engineer, who has been for some time past in this country and has lately been connected with the National Cash Register Company at Dayton, Ohio, is returning to England to take up work for the British Ericsson telephone interests. Mr. Scruby has made a special study of the manufacture of telephone apparatus.

MR. H. E. VINEING, electrical engineer of the New York Fire Department, has been called upon for his resignation. He was at one time in charge of the Borough of Richmond fire alarm telegraph system and was later engaged on the underground work in Brooklyn. It is said that no successor will be appointed—at least for the present.

MR. J. MAXWELL SMITH, a native of Cape Cod, Mass., is wireless telegrapher with Mr. Walter Wellman, the newspaper correspondent, who is to make a balloon trip in search of the North Pole. He has served with the Commercial Cable Company. Mr. Wellman sent a wireless message on July 21 to President Roosevelt from his preparatory station, via Hammerfest, Norway.

MR. N. W. THOMPSON, who has been local manager of the Nebraska Telephone Company at Lincoln, Neb., has been transferred to the general offices of that branch of the Bell system, at Omaha, under General Manager Vance Lane. He has been with the company for 17 years. He is succeeded at Lincoln by Mr. Lee Huff, manager at Grand Island, who in turn is succeeded by Mr. Lloyd Wilson from Central City.

MR. T. A. EDISON.—In an interview with Mr. James Creelman, given in *Pearson's Magazine*, Mr. Edison expressed the opinion that the world was on the eve of another great discovery. He would not be surprised any morning to wake up and learn that some one had hit on the secret of producing electricity by a "direct process." The more he thinks about it the more confident he is that the achievement will be made before he dies.

MR. LEONARD HURTZ, city electrician of Lincoln, Neb., has resigned and will become manager of the automatic system of the Lincoln Telephone Company. He is a graduate of the electrical department of the State University, and served a post-graduate course in the employ of the local gas and electric lighting company before taking up the responsible duties of city electrician in the equipment and conduct of the new municipal lighting plant.

MR. W. S. BARSTOW, of W. S. Barstow & Co., Inc., engineers, of New York City, has just returned from Portland, Oregon, after a four weeks' trip. He reports that there is in contemplation the building of several miles of railroad extensions in connection with the Oregon Electric Railway Company, for whom the Barstow Company are now building and equipping about 60 miles of road. It is expected that part of the main line between Portland and Salem will be in operation September 1st and that cars will be operated between the two cities by July 1, 1907.

MR. GEORGE H. GUY, secretary of the New York Electrical Society, has been seriously invalided during the past month by his involuntary participation, on the Long Island Railroad, in a collision between electric and freight cars. He is still feeling the effects of the shock, but after three weeks of absence from his multifarious duties, has persuaded the doctor to let him out, as so many important matters demanded attention. Mr. Guy is also the secretary of the building fund of the Institute, and corresponding secretary of the new Illuminating Engineering Society.

MR. T. A. EDISON.—Two hundred and fifty Edison agents, jobbers, etc., were the guests of the Columbia Phonograph Company at a banquet in the Astor Gallery of the Waldorf-Astoria on July 20. The entertainment was the last of a round of four days of festivities which had been provided by the Phonograph Company. Among those present at the banquet were Mr. Thomas A. Edison and President William E. Gilmore of the Columbia Phonograph Company. There were no speeches, but a musical programme was provided by the Edison Symphony Orchestra and several vaudeville artists appeared.

MR. J. B. McNAMARA, of Cairo, chief electrical engineer of the State Railways of Egypt, has been making a tour of this country, during which he has inspected the Pennsylvania, New York Central, Long Island and other electrified steam roads, and has visited Schenectady, Pittsburg, Milwaukee and other cities. He expected to return by the *Patricia* July 28. Mr. McNamara stated that the management of the State Railways of Egypt has decided to install a 19-km. single-phase line near Cairo and put a 10-min. service in operation. The road has previously been operated by steam. Bids will be asked for the construction of this line probably in January.

MR. J. W. LIEB, JR., associate general manager of the New York Edison Company, has just returned with Mrs. Lieb from an extended European trip. In Italy he received many personal attentions as a guest of honor, and in England he participated in all the lavish hospitalities of the British Institution of Electrical Engineers, of which he speaks in most glowing terms. On the voyage home, Mr. and Mrs. Lieb had to exchange from the disabled *Deutschland* to the *New York*, and on the latter steamer assisted in mid-ocean in the rescue of the crew of a wrecked Norwegian vessel. Mr. Lieb now takes a rest in resuming his regular duties.

MR. W. M. EATON, second vice-president and general manager of the Rochester, N. Y., Railway & Light Company, will turn over the managerial duties on August 1 to Mr. R. M. Searle, who has been general manager of the Westchester, N. Y., Lighting Company. Mr. Eaton will retain the office of second vice-president of the Rochester company, as of old, and there will be no change in the heads of departments. The change is made for no other purpose than to relieve Mr. Eaton of detail work. After Mr. Searle has become acquainted with the properties in his charge and the territory they cover, Mr. Eaton will continue the vacation begun in May, for the purpose of regaining the strength that has been exhausted during the last nine months. Immediately upon the close of his leave of absence he will return to his duties.

MR. T. F. RICHARDSON.—Mr. Thomas F. Richardson, department engineer of the Metropolitan Water and Sewerage Board, of Boston, has ended his service with the State Commission to accept a position as resident manager of the Rockingham Power Company, at Rockingham, N. C. The Westinghouse Electric Company is interested in the project to be exploited, which promises a great industrial development of the section of the State of North Carolina within a radius of 100 miles from Rockingham. Mr. Richardson has been the leading engineering factor in the construction of the Wachusett dam and auxiliary works. He made the preliminary investigation when the State Board of Health was seeking a source of water supply for the Metropolitan district. When the commission was appointed he went to Clinton and had charge of the preliminary work for the finding of a site for the Wachusett dam and the aqueduct was built under his supervision. The Wachusett dam is his monument, and he had charge of the relocating of the Central Massachusetts Railroad and other lesser projects.

MR. E. W. T. GRAY, who has for years been manager of the New York sales office of the Westinghouse Electric & Mfg. Company, resigned recently to take up commercial work in another field. Mr. Gray's decision to sever his connection with the Westinghouse Company was received with great regret by the management, he having been one of the pioneer employes of the company. Mr. Gray began his work with the Westinghouse Company about the year 1890, starting in the laboratory of their original works in the heart of the city of Pittsburg. Later he took up installation work for the company, installing the first railway motors the company made on cars in Lansing, Mich., about the year 1893. Following a short period spent in installation work, Mr. Gray was called by the company to its sales organization with headquarters at Pittsburg. In 1898 Mr. Gray received the appointment of manager of the New York office. Mr. W. C. Webster, who succeeds Mr. Gray as manager of the New York sales office, has a broad general knowledge of the company's commercial policy, and on account of his close association with the sales department in the past enjoys a personal acquaintance with the entire sales force, which should be of great advantage to him in his new work. Mr. Webster entered the employ of the company in 1898, and has always been identified with the sales department.

Trade Publications.

DUDELL OSCILLATORS.—List No. 20 of the Cambridge Scientific Instrument Company, Ltd., Cambridge, England, describes in great detail the various forms of the Dudell oscillograph. Several folding sheets give excellent reproductions of oscillograph records.

CHLORIDE ACCUMULATORS.—Bulletin No. 98 of the Electric Storage Battery Company has for its subject the chloride accumulator in central station lighting and power plants. A large number of load curves renders this bulletin of particular interest to central station men and to electric engineers in general.

IRONING BY ELECTRICITY is the title of a very dainty little pamphlet, envelope size, issued by the Western Electric Company, and devoted to the electric flatirons made by the General Electric Company. These irons weigh 3 and 6 pounds and are an economical investment for every purchaser. This little brochure is one that many central stations could use to advantage.

ANNUNCIATORS AND BURGLAR ALARMS.—Bulletin No. 150 A of the Holtzer Cabot Electric Company, Brookline, Mass., is devoted to annunciators, burglar alarms, and interior telephones. In one section is illustrated a very interesting system of restaurant calls and a laboratory kitchen lunch installation. The latter consists of 72 36-drop and two 14-drop annunciators with button plates for transmitting orders.

"EDISON PRIMARY BATTERIES" is the title of a 16-page pamphlet describing and listing the Edison caustic potash cell. This battery is distinguished from others of the caustic potash type by having the copper dioxide compressed into briquettes and this method of construction is justified by a quotation from Prof. Carhart, as follows: "Recognizing the good qualities of copper oxide as a depolarizer, Edison has devised a form of design to meet the objections. The copper oxide is employed in the form of a compressed slab which, with its connecting copper support serves also as the negative plate. In recent cells the device has been resorted to of reducing a superficial film of copper on the oxide before it is sent from the factory."

A JOURNAL OF INDUSTRIAL OPPORTUNITIES.—*The Machine Tool Pocket List,* formerly published by the Angus Ballard Company, has been purchased by the Geo. H. Gibson Co., advertising engineers, Park Row Building, New York City. The size of the book will be increased from 3½ inches by 6 inches to 4 inches by 9 inches, a larger pocket or pigeon-hole size, and the buyers' finding list of machine tools and supplies will be made still more complete and definite if possible, although the present list covers over a thousand firms and about two thousand articles and types of tools used in machine shops. Brief articles of interest to manufacturers of machinery will also be added and the *List* will be combined with *Manufacturing,* a journal in which the Geo. H. Gibson Co. describes and lists important patents and other industrial opportunities.

BALDWIN LOCOMOTIVES.—Among the handsomest catalogues issued in this country are those of the Baldwin Locomotive Works, Philadelphia, Pa., and two recent ones fully sustain the high character of these publications. These are "Record of Construction," Nos. 56 and 57. The former deals with locomotives supplied to the Atchison, Topeka & Santa Fe Railway System, and an interesting feature consists of description with illustrations of successive types of Baldwin locomotives supplied to this railroad from 1879 to date. Record No. 57 has for its subject the locomotive equipment of the "Associated Lines," which comprise the Southern Pacific, Union Pacific, Oregon Short Line, Oregon Railroad & Navigation Company and the Chicago & Alton Railway.

News of the Trade.

THE NEWTON MACHINE TOOL WORKS COMPANY, Philadelphia, has elected new officers as follows: Harry W. Champion, president; William M. Graham, treasurer; Ellis J. Hannum, secretary. The election of new officers was occasioned by the death of Mr. Charles C. Newton, founder and president of the company, with whom the above-named officers have been closely associated in executive positions for many years. No changes in the conduct of the business will be made.

THE ELECTRIC SERVICE SUPPLIES COMPANY has opened offices at No. 922 Missouri Trust Building, St. Louis, Mo., in charge of Mr. Ernest Boehme. All correspondence, orders, etc., addressed there will receive prompt and personal attention. A full line of samples will be carried at this office of Keystone insulation, overhead line material, Garton-Daniels lightning arresters, and other specialties of the company. This step is an indication of the progressiveness of the Electric Service Supplies Company, and is a beginning of many changes it intends making that will benefit its patrons.

DODGE & DAY.—We understand that the facilities offered by their new office in the Drexel Building, Philadelphia, have enabled Messrs. Dodge & Day to make some important changes in their methods and organization. The principle among these have been occasioned by the marked development of the department formed for taking care of such construction as their clients desire to have them attend to in preference to calling in outside concerns. The immense advantage of placing the construction of buildings and installation of equipment in the hands of the concern that has been responsible for the design and layout, thus centering the responsibility, has been apparent to so many manufacturing companies that a demand has risen for an organization equipped to handle an operation from inception to completion. The development of Dodge & Day's construction department has made it possible for them to supply this demand, and a number of their recent commissions have been secured on this basis.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JULY 17, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

825,894. TELEPHONE SYSTEM; William W. Dean, Chicago, Ill. App. filed Feb. 8, 1904.

825,927. ELECTRICAL SIGNAL SYSTEM; Carl P. Nachod, Wilkinsburg, Pa. App. filed Aug. 2, 1905. A signal system for single-track trolley roads having turn-outs at spaced intervals. Has a circuit closing wheel which is stepped around by a magnet whenever a car enters a block, and which is reversely rotated by another magnet whenever the car leaves the block.

825,938. ELECTRIC COOKER; George J. Schneider, Detroit, Mich. App. filed June 28, 1905. A special form of grid or casting has pins projecting therefrom around which are woven spiral resistance elements through which the current passes to heat the oven.

825,954. CLEAT FOR ELECTRIC WIRES; Charles C. Blake, Brookline, Mass. App. filed Oct. 27, 1905. A cleat for electric wires made of compressed wood. The cleat is properly grooved across the grain of the wood to receive the circuit wires.

825,974. BRUSH HOLDER FOR ELECTRICAL MACHINES; Chester B. Mills, Wilmerding, Pa. App. filed Oct. 3, 1904. A form of fixture for supporting the brushes of an electric generator which is applicable to different sizes of machine. The angle of the brush holder can be adjusted and the degree of projection of the brush therefrom also varied.

825,981. METHOD OF CONVERTING SPONGY LEAD INTO LEAD SULFATE; Charles J. Reed, Philadelphia, Pa. App. filed May 7, 1903.

825,986. VOLTAGE REGULATOR; Harve R. Stuart, Wilkinsburg, Pa. App. filed Apr. 14, 1904. The circuit is broken by a series of plungers within an oil bath which have lever connections with cams on a shaft which is geared to be operated by a hand crank.

825,988. RAILWAY SIGNALING SYSTEM; Louis H. Thullen, Edgewood Park, Pa. App. filed June 20, 1905. Relates to signaling systems of that class in which the track rails are energized to a difference of potential by direct current battery, and also an alternating current from a transformer.

825,991. SEMAPHORE; Jean F. Webb, Denver, Col. App. filed July 21, 1905. Details of construction of a semaphore apparatus having a plurality of colored lenses supported about a revoluble shaft which may be stepped around by a ratchet and solenoid.

825,995. CONDUIT RECEPTACLE; Frank T. Wheeler, Plainville, Conn. App. filed Oct. 25, 1905. A porcelain housing has the usual threaded shell cemented therein and the stud contact is embedded in a button with a concave under side to which the terminal wire is soldered.

826,003. SYSTEM OF SIGNALING; Paul Winsor, Weston, Mass. App. filed Jan. 27, 1902. Details of a signal system having the track rails energized by an alternating current and the semaphore relays in a transformer circuit therewith.

826,048. TEMPERATURE ALARM; William T. Munro, East Blairlinn, Cumbernauld, Scotland. App. filed Sept. 22, 1904. A bent glass tube has a bulb at each end, one having thick walls and the other thin walls. A slow rise of temperature causes a displacement of a mercury column in the tube and closes an alarm circuit, while a rapid rise in temperature causes different displacement of the mercury and gives another alarm signal.

826,050. TROLLEY POLE; Augustus Neubert, Elizabeth, N. J. App. filed Nov. 5, 1903. The harp has a pair of flaring prongs projecting upward therefrom on each side, the purpose of which is to prevent the trolley leaving the wire when passing cross-town arches.

826,072. OUTLET BOX; Robert McK. Thomas, Elizabeth, N. J. App. filed July 8, 1905. An outlet box having a smooth zinc exterior wall and weakened circular sections behind said wall so that holes may be knocked in the box for the outlet cables when desired.

826,090. ELECTRIC SIGNALING AND TESTING SYSTEM; John Doran, Schenectady, N. Y. App. filed Mar. 23, 1906. A fire alarm system having a closed circuit which includes an electrolytic cell to oppose flow of current in one direction. Means are provided for periodically reversing the current so as to provide a test for the continuity of the circuit.

826,097. CONDUIT OUTLET BOX; Arthur Frantzen and William H. Rattenbury, Chicago, Ill. App. filed Mar. 24, 1903. In order to avoid carefully fitting an outlet box into place in its wall or floor, the patentee has a construction which is depressed below the surface of the wall and provided with a separate plate which is adjustable on the neck of the outlet box and which can easily be positioned to lie flush with the wall or floor.

826,136. BOND; Francis B. Badt and George M. Willis, Chicago, Ill. App. filed Mar. 10, 1902. The bond has tubular plugs at each end which may be inserted into the rails and expanded therein like an ordinary boiler tube so as to make a good connection.

826,138. COLLECTOR; Benjamin H. Bedell, London, England. App. filed Nov. 22, 1904. Relates to railways of that class which receive their current from stationary contact plates along the road. The car has a chain depending therefrom which is depressed to make electric contact only at the point opposite a contact plate.

826,152. CLUSTER SOCKET; John H. Dale, New York, N. Y. App. filed May 25, 1905. Relates to series or multiple cluster sockets. A construction which permits easy assembling of the parts within the usual hemispherical housing employed. The threaded shells are carried by pivoted arms from the supporting base for this purpose.

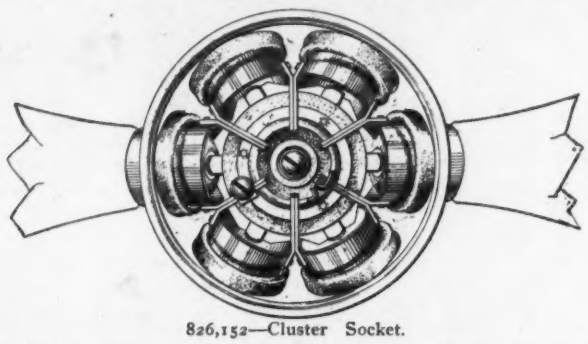
826,173. STORAGE-BATTERY PLATE OR ELECTRODE; Alfred E. Knight, Somerville, Mass. App. filed Nov. 8, 1905.

826,199. SWITCH OPERATING MECHANISM; Arthur E. Stevenson, Buffalo, N. Y. App. filed Oct. 12, 1905. Special trolleys are laid between the usual track rails and collector rollers depend from the wheel axles and are spring pressed so as to engage the trolleys.

826,206. COMBINED SAFETY CLUTCH AND WIRING SYSTEM; Harry A. Williams, Akron, O. App. filed Oct. 22, 1904. Comprises a magnetic dutch of the disc type and a circuit therefor including cut-outs at various points which may be tripped to release the clutch by cords depending within easy reach of the operators at the various machines.

826,220. TELEPHONE SYSTEM; Charles V. Beaver, Anita, Ia. App. filed July 5, 1902.

826,225. INCANDESCENT LAMP SOCKET; Dudley B. Fullard and John J. Miniter, Bridgeport, Conn. App. filed Oct. 13, 1904. The lamp has a magnet through which the current passes and which



826,152—Cluster Socket.

holds the lamp switch in closed relation. Whenever the circuit is interrupted the switch automatically opens so as to put out the lamp. The lamps are designed to be put out at night by a control from the power station.

826,231. ELECTRIC APPARATUS FOR PREVENTING TRAIN WRECKS; Carmelo Del Campo, New York, N. Y. App. filed Nov. 15, 1905. Locomotive carries an arm which depends in proximity to the track so as to be displaced and ring an alarm circuit in case the locomotive goes through an open switch. In this way the engineer is informed that he has been switched over onto a side track.

826,248. CIRCUIT BREAKER; Edward M. Hewlett, Schenectady, N. Y. App. filed May 24, 1898. Details of construction of a circuit breaker having an actuating toggle and means for directing the latter to free the actuating toggle and allow the breaker to open.

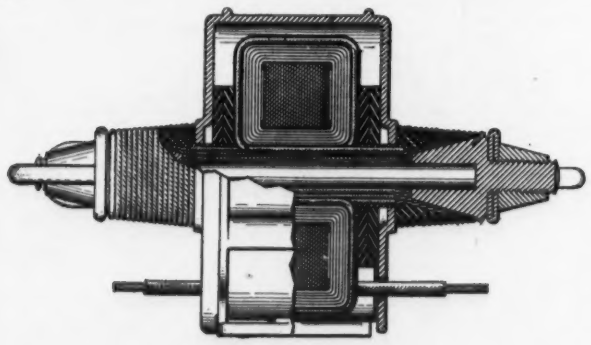
826,256. RAILWAY BLOCK SIGNAL SYSTEM; Charles M. Kirwan, Baldwinsville, N. Y. App. filed Apr. 18, 1905. The trains carry tappets on the axles thereof which actuate circuit closers in the roadbed. In case the trains are too close together train stop-arms are automatically tripped into position to close an alarm circuit on the rearmost train.

826,272. ELECTRIC METERING SYSTEM; William H. Pratt, Lynn, Mass. App. filed Feb. 9, 1903. A polyphase relay consisting of a rotatable member, a plurality of motor elements acting upon said member, and circuit controlling means operating upon the movement of the member in one direction to complete the given circuit and to close another circuit when moving in the opposite direction.

826,283. TRANSFORMER; Louis M. Schmidt, Lynn, Mass. App. filed Aug. 7, 1905. A construction of small transformer used in connection with measuring instruments where it is desired to derive a secondary current bearing a definite relation to and usually much smaller than a varying primary current.

826,287. ELECTRICAL CONNECTION; Charles W. Svenson, New Britain, Conn. App. filed Sept. 1, 1904. A spark plug connection having a pair of metallic clips each perforated so as to engage a ball on the end of the connection wire.

826,296. TROLLEY; Gurney E. Ward, Abilene, Tex. App. filed Aug. 11, 1905. The upper end of the trolley pole is flared into a V-shaped box or cavity in which a pair of trolley wheels are contained. One of the trolley wheels is independently spring pressed upward in the box.



826,283—Transformer.

826,301. ELECTROCHEMICAL PROCESS OF PRODUCING NITROGEN COMPOUNDS; John W. Wood, Moulton, Ia. App. filed Feb. 21, 1902.

826,307. ELECTROMAGNET; Walter W. Brown, Schenectady, N. Y. App. filed Jan. 9, 1905. Details of construction of a magnet used in connection with a circuit breaker and particularly designed to produce a quick break thereof.

826,310. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; Albert M. Bullard, New York, N. Y. App. filed Oct. 16, 1905.

826,315. ELECTRIC RAILWAY MOTOR; Patrick J. Collins, Scranton, Pa. App. filed Jan. 3, 1905. The frame in which the car axles are journalled forms a part of the field magnet of the generator. The motor armatures are directly keyed upon the wheel axles.

826,317. SELECTIVE SIGNAL SYSTEM; William W. Dean, Chicago, Ill. App. filed Jan. 14, 1902.

826,318. SPEED CONTROL SYSTEM FOR ELECTRIC MOTORS; Alexander D. Du Bois, Chicago, Ill. App. filed Apr. 8, 1905. The motor has a solenoid operated starting rheostat and in addition thereto a hand-operated rheostat so that the motor may be started and stopped as often as desired and set to come to any desired speed.

826,319. TROLLEY POLE; Pemberton Dudley, Asbury Park, N. J. App. filed Aug. 11, 1905. The trolley pole has a joint by which it is laterally flexible, the upper section being spring impelled to normally maintain a vertical relation.

826,341. FLUID PRESSURE GOVERNOR; George Macloskie, Schenectady, N. Y. App. filed Jan. 9, 1904. Relates to a starting switch for a fluid pressure motor in an air brake system. Has a diaphragm and a spring pressed plunger and a lever system for imparting an abrupt movement to the circuit closing switch.

826,350. SELECTOR FOR AUTOMATIC TELEPHONE-EXCHANGES; James L. McQuarrie, New York, N. Y. App. filed Oct. 16, 1905.

826,359. SUPPORT FOR INCANDESCENT ELECTRIC LAMPS; Adolphe Romain and Jean D'Ayguesvives, Paris, France. App. filed Sept. 6, 1904. A multiple or cluster socket adapted for a special construction of incandescent lamps. Each receptacle has two spring pressed plungers through which the electrical connections are made.

826,362. GOVERNING CONTINUOUS CURRENT MOTORS; Gaston Sautter, Paris, France. App. filed Nov. 11, 1902. A construction of contactors for automatically starting an electric motor. The contacts are magnet operated and are designed to be successively tripped into action.

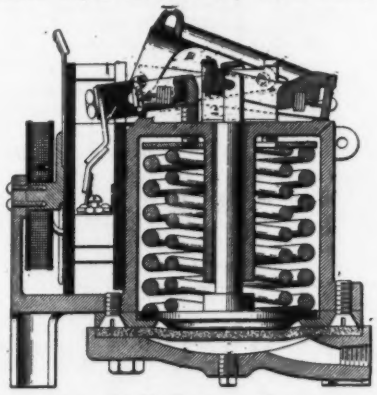
826,367. AERIAL ELECTRIC TRANSPORTATION SYSTEM; George G. Schneider, Washington, D. C. App. filed Nov. 14, 1904. A telpherage system in which the car has a motor contained within the main driving wheel. The car has pair of trolley poles which engage separate aerial conductors.

826,403. TELEGRAPH KEY; Joseph P. Campbell, Pulaski, Va. App. filed Jan. 29, 1906. In order to make the key more easy to manipulate, the patentee has a supplemental lever which carries one contact, the other contact being directly carried by the key levr.

826,429. SELF REGULATING SYSTEM OF ELECTRICAL DISTRIBUTION; Albert S. Hubbard, Greenwich, Conn., and Edward Lyndon, New York, N. Y. App. filed Nov. 3, 1903. A special arrangement of circuits for obtaining constant potential in an electric railway. Employs the usual boosters and assisting magnet coils on the main generators.

826,435. EXTRACTING METALS BY ELECTROLYTIC MEANS FROM ORES; Alexander Lenart, Jr., Budapest, Austria-Hungary. App. filed Aug. 18, 1905.

826,439. TROLLEY; Bryan McManaman, Wilkes-Barre, Pa. App. filed



826,341—Fluid Pressure Governor.

Sept. 7, 1905. The trolley wheel has spring teeth or prongs bolted to the wheel flanges and inwardly directed so as to close over the conductor. The purpose is stated to be for keeping the trolley on the wire in passing switches, etc. Also has a feature by which the wheel is readily removable.

826,440. TROLLEY STAND; Bryan McManaman, Wilkes-Barre, Pa. App. filed Oct. 3, 1905. In order to prevent abnormal elevation of the pole in case the trolley leaves the wire, the pole has springs connected thereto. The pole is pressed upward against the tension of the springs by a weight.

826,457. ELECTRIC SIGNALING SYSTEM; Jean F. Webb and Clayton E. Frederickson, Denver, Col. App. filed Nov. 1, 1905. Signaling device of that character having a ratchet wheel at each sub-station, all of which are stepped around synchronously by impulses transmitted through the line.

826,472. TELEGRAPHY; Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y. App. filed Dec. 7, 1901. A duplex telegraph having an automatic transmitter and a manual transmitter, together with a switch at each station and a message tape for operating said transmitter in which several sections of the message are separated by divisional spaces.

826,474. CONTROLLER REGULATOR; Charles N. Butler, Philadelphia, Pa. App. filed Aug. 11, 1905. The frame in which the trolley wheels thereon with depending ears which are engaged by cam operated lever so as to prevent too abrupt movement of the controller arm.

826,478. ELECTRIC RAILWAY MOTOR; Patrick J. Collins, Scranton, Pa. App. filed Aug. 11, 1905. The frame in which the trolley wheels are journalled serves as a part of the field magnets of the motor. The motor armatures are directly keyed to the driving wheel axles.

826,494. CONTROLLER REGULATOR; John P. Durkin, Philadelphia, Pa. App. filed Nov. 20, 1905. The controller shaft has a ratchet-shaped cam thereon, which moves in proximity to stationary cam inclines. A pivoted finger is moved back and forward between the cams so to prevent abrupt movement.

826,495. CONTROLLER REGULATOR; John P. Durkin, Philadelphia, Pa. App. filed Jan. 8, 1906. Relates to a modification of the above in which a ball is used instead of a pivoted finger.

826,503. MOTOR SUPPORT; Ezra Haskell, New York, N. Y. App. filed Dec. 14, 1903. A dental motor is supported by trunnions within a gimbal ring so as to permit movement in any direction.

826,526. RECIPROCATING BRUSH DEVICE; Harry L. Rambeau, Cincinnati, O. App. filed Oct. 6, 1903. All of the brushes around the commutator are connected by links which may be reciprocated so as to turn a ratchet at each brush. This ratchet serves to give a to and fro movement to each brush by means of a cam.